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with CHEMICAL & METALLURGICAL ENGINEERING

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COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

Volume 55 | MARCH · 1948 | Number 3

Caustic soda and soda ash prices in the resale market have tobogganed. Exporters who got as high as 14 or 15c. a lb. for caustic soda are offering to sell at almost half those prices. Soda ash, which has been selling at more than 5c. a lb., is offered at 2½c. When OIT decided upon price criteria to govern granting of export licenses, it deliberately sought to bring down soaring alkali prices. The day of 300 to 500 percent marks-ups on black-market alkalies going abroad is over. But exporters kick about controls. Pinched tightly are the independent non-manufacturing traders. They may be squeezed out by the Alkali Export Association.

•

Synthetic fuels program got a big boost when Defense Secretary James V. Forrestal introduced the element of national security. And the recent fuel shortage did not hurt either. His reputation as a New Dealer handicaps Interior's Secretary Julius A. Krug on Capitol Hill. Now that Forrestal has come out for Krug's plans they will get more attention from legislators. Already Congress has approved an extension of Interior's present synthetic fuels program until April 1953, increasing at the same time the authorized appropriations by $30 million to a total of $60 million.

Construction of three 10,000-barrel-a-day plants to produce liquid fuels from coal and shale is authorized in a bill submitted by Representative Charles Wolverton, New Jersey Republican. The bill calls for construction and operation by private industry. If private industry does not tackle the job with loans from RFC, then RFC is authorized to build and operate the plants. An appropriation of $400 million is called for.

Coal is odds-on favorite as raw material in all long-range plans for a synthetic fuels industry. Its abundance recommends it instead of cheaper natural gas. One-quarter of the proved reserves of natural gas, if used to make liquid fuels, would be gone in two decades. It would furnish only 400,000 barrels a day of gasoline or about 15 percent of current demand. Enough gasoline and oil to meet total United States demands for 1,500 years, estimates Dr. Homer Z. Martin of Standard Oil Development Co., could be made from one-quarter of its known coal reserves.

With these coal estimates mining engineer Andrew B. Crichton of Johnstown, Pa., takes issue. Instead of reserves to last for 2,000 years or more, only enough coal for about 250 years, he believes, would show up in a realistic survey. In the industrialized East, where 92 percent of the coal is mined and used, he thinks there is probably no more than a 90-year supply.

Krug's $9 billion program would require 16,000,000 tons of steel. It would also need copper, concrete and electrical machinery. It would taken from 5 to 10 years to complete. Petroleum industry thinks it would be a lot wiser to put that money and steel into facilities for producing, transporting and refining oil. It is stepping up its 18-month expansion program with government help.

•

Synthetic rubber legislation is now at the critical stage. Congress this month must decide on a peacetime program. The Shafer bill, unanimously approved by a Republican-controlled House Armed Services Committee, is backed by the Administration, the small rubber manufacturers and the big users of rubber products. But major rubber companies have rallied to support a counter-measure sponsored by Republican Senator John Bricker of Ohio. Although the Shafer bill may get through intact, it is more likely that some provisions of the Bricker measure, such as a specific termination date, may be incorporated in the final draft reported out by the House-Senate conference committee.

Under the Shafer bill, the government would keep control over the rubber industry for perhaps another five years or longer. Before the Administration could dispose of a plant the National Security Resources Board would have to approve. Congress would have to concur. Required capacity, both op-

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erating and standby, would total 600,000 tons of general-purpose and 75,000 tons of special-purpose rubber a year. The President could require production and use of at least one-third, and possibly more, of these amounts. The Chief Executive also could negotiate modifications of wartime patent-sharing agreements.

Under the Bricker bill, the government could immediately sell any capacity in excess of 600,000 tons of general-purpose and 65,000 tons of special-purpose rubber a year. Capacity requirements gradually would be whittled. In June 1950 the government would get out of the synthetic rubber business. After that it would have to sell all its facilities to private interests. Meanwhile, no minimum on either production or required use would be set. The President would be authorized and directed to attempt to end further patent-pooling and cross-licensing. The Administration would be required to report its disposal plans by April next year. An industry advisory committee would be authorized to consult with administrators on how much synthetic the industry should be required to use. Production at any plants leased between now and the expiration of the act could not be used to satisfy mandatory use requirements.

•

Output of scarce domestic minerals should be subsidized. That is what Dr. James Boyd, who is serving as Director of the Bureau of Mines, told a subcommittee of the House Public Lands Committee during its hearings on United States mineral resources. He also admitted that the United States could develop a sizable manganese industry only by generous subsidies. At these remarks western Congressmen chortled. The subcommittee, headed by Representative William Lemke, North Dakota Republican, is made up largely of western and midwestern Congressmen. Such subsidies would be a shot in the arm to mining industries in their home states. Representative Clair Engle, California Democrat, criticized President Truman for vetoing an act last summer that carried $35 million of such subsidies for copper, lead, zinc and manganese.

•

Information on strategic raw materials, hitherto highly confidential, is withheld from them by civilians in government and the military. So complain certain Representatives from the Western States. Representative Clair Engle, California Democrat, has even called close-mouthed Munitions Board officials in contempt of Congress.

Full of sound and fury, this Congressional appeal for information may signify not so much whetted interest in strategic materials as unpopularity among some legislators of Dr. James Boyd, recent nominee to the post of Bureau of Mines Director. That this controversy came while Boyd and his aides were before a subcommittee of the House Public Lands Committee emphasizes this suspicion. In Washington it is known that John L. Lewis, craggy chieftain of the United Mine Workers, bitterly opposes Boyd as prospective Bureau of Mines Director. Impartial observers, meanwhile, are hard put to find more legitimate military secrets than strategic stockpile data.

•

Interdepartmental Committee on Research and Development named in mid-February has 12 members and two alternates. When he picked this Committee, President Truman took his third step to implement a major finding of his Scientific Research Board. It was the one last step his advisers had suggested instead of the National Science Foundation he vetoed last August.

From Truman's action in naming the Interdepartmental Committee some have inferred that the President does not expect Congress to give him an acceptable Foundation bill to sign this year. That was how the wind blew in February. But in March the wind has veered.

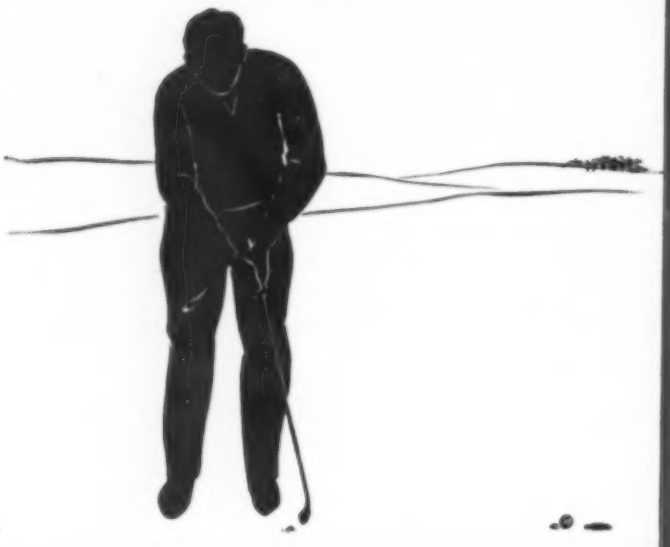
Now many definitely have agreed on a proposed bill. The President says he will sign it. Even the Vannevar Bush forces have been won over. In any other year this would have clinched passage. But in this election year the political pot boils. Opposition may develop unexpectedly. Behind the bill there is agreement but no great pressure. And legislators hesitate to tack any more bills on the "must" list for enactment before the June conventions. This in itself is a formidable road block on the bill's way to become law. Proponents' hopes, however, run high. Even if the bill passes, a Foundation can hardly get going until 1949.

•

Alien Property officials are now selling a study made by the Dow Chemical Co. of European phenol production by the Raschig process. In a dicker with Dow executives they gained apparently reluctant permission to treat this big report like the seized patents relating to the same process. Nor is this the first such case.

It looks as though Department of Justice officials handling alien property disposal expect as a matter of policy to reveal all process developments and secrets. In several cases this is being done, or at-

(Continued on page 76)



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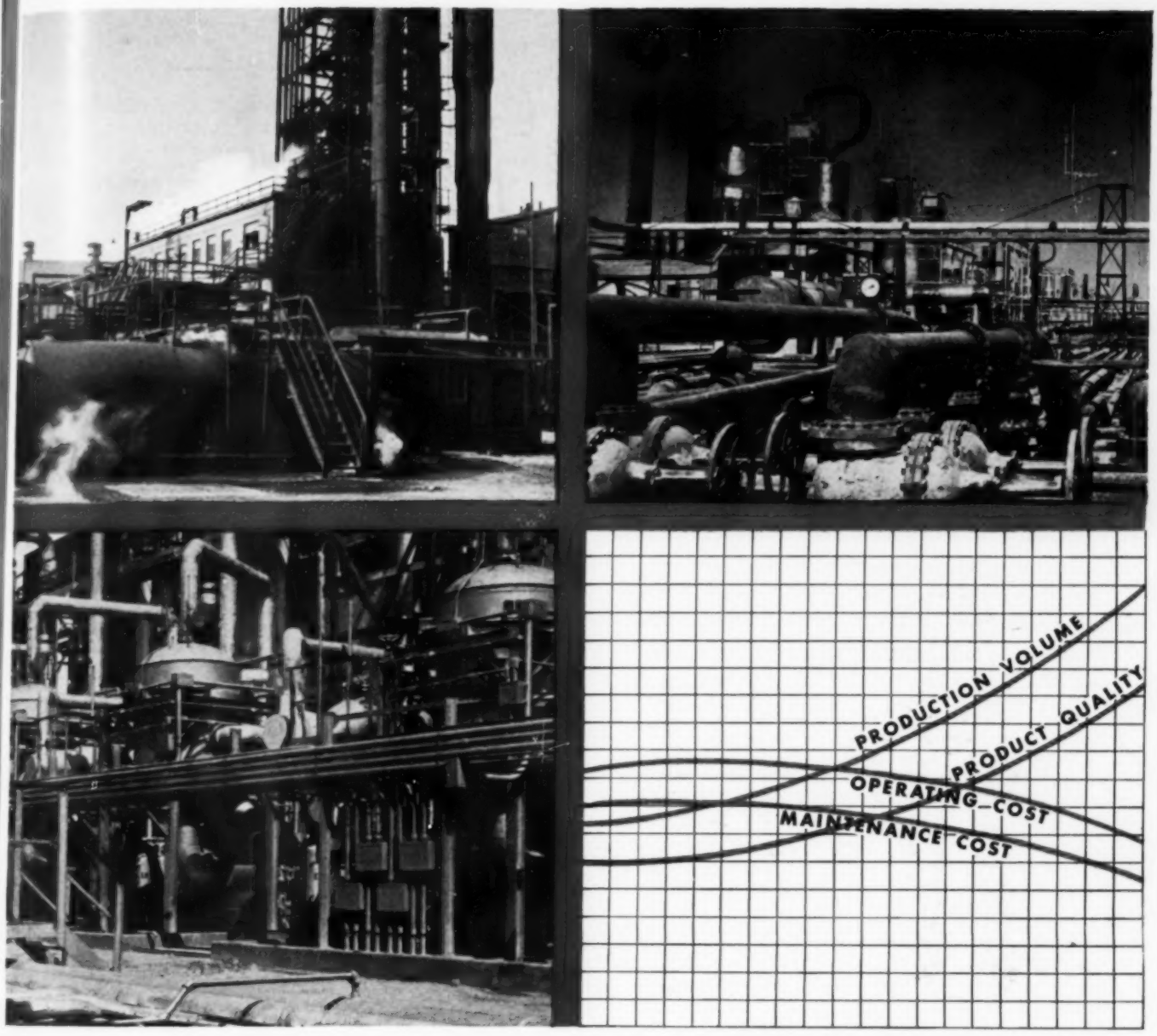

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(*Continued from page 73*)

tempted, even though United States firms thought they had exclusive patent assignments for use in this country.

•

New acid-resistant glass is the first known to withstand attack of hydrofluoric acid. Containing no sand, the glass is composed largely of phosphorus pentoxide. It was developed for use with uranium hexafluoride in the atomic bomb project. The glass promises to simplify handling and transporting of hydrofluoric acid. Plans are under way for its commercial manufacture.

•

Plutonium poisoning took the lives of thousands at Hiroshima and Nagasaki. To those who work with plutonium it is an ever-present possibility. In any future atomic war it would produce casualties. Now two treatments for plutonium poisoning are announced.

Radioactive plutonium in a living organism can be displaced by zirconium. The displaced plutonium is eliminated from the body, reducing radioactivity. This treatment was devised by Dr. Jack Schubert, physiological chemist who worked for the Manhattan District. He injected zirconium salts into animals with plutonium poisoning. Extensive tests at the metallurgical laboratory of the University of Chicago and the Argonne Atomic Laboratory there indicate that the method would be effective on humans.

Plutonium poisoning causes death by breaking down the walls of veins and arteries, bringing internal hemorrhage. Death can come immediately or it may be delayed many weeks.

From the University of Rochester comes word of another treatment which may be combined with Schubert's. Rutin, the flavonol glucoside now extracted from the buckwheat plant, is used to prevent hemorrhage by strengthening veins and arteries. While the rutin treatment does not get rid of the radioactive plutonium, it might prevent death long enough for zirconium to do its work. Rutin also has great promise in the battle against high blood pressure. It reduces the fragility and permeability of capillaries that accompany hypertension.

•

Chloromycetin is going into action against scrub typhus. U. S. Army Medical Department is committed to extensive tests of the new antibiotic this spring in the Malay States. Plantation workers there are felled by the disease. Scrub typhus is no new foe to Army medicos. They fought it all through the Pacific war. Efforts to produce a vaccine cost the lives of three American and British workers. At war's end there was no vaccine. Now comes chloromycetin, first drug effective against rickettsial diseases, of which typhus is one. At work in such diseases is an organism tinier than the bacteria but larger than the viruses.

•

Partial acetylation of cotton fiber by a new rapid process gives fabric a high rot-resistance. Credit for this achievement goes to Department of Agriculture's Southern Regional Research Laboratory. Best means yet discovered to protect cotton fabric and yarn from mildew and other rot, the process converts part of the fiber chemically to cellulose acetate. No other treatment gives as much resistance against organisms causing rot. These organisms bring high dollar losses each year in cotton products exposed to dampness. Moreover, the treatment causes no discoloration, imparts no odor and does not make cotton sticky or poisonous. Some other rot-proofing treatments do. Both fabric and yarn can be partially acetylated. The methods are fast and highly practical. Many uses are foreseen.

•

Vegetable protein fibers will go into many of tomorrow's textiles. Industrial production of peanut, soybean and corn protein fibers may come this year. Solvent extraction will boost production of oils and protein meals. Derived proteins will go into fibers. Oilseed proteins, including cottonseed and flaxseed, are slated for a big role in textile production.

Research spearheads the advancing technology of the protein fiber industry. Wet and dry tensile strengths of regenerated fibers improve. Hardening and stretching agents make their bow. Fibers are modified chemically. They are combined with natural or other synthetic fibers. Protein suspensions are extruded onto the surface of cotton or other fibers.

•

Virginia-Carolina Chemical Corp. will produce regenerated protein fibers at its newly acquired plant in Taftville, Conn. The plant was purchased from National Dairy Products Corp. for more than $1 million cash. High cost of casein from skim milk forced National Dairy Products to get out of the casein fiber field and sell its Aralac plant. Virginia-Carolina plans to use vegetable proteins, probably from peanuts, as basic raw material because of their lower cost. Believed the first of its kind produced

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To research on vegetable protein fibers Virginia-Carolina devoted many years. It operated a pilot plant at its Carteret, N. J., laboratory. Department of Agriculture's Northern Regional Research Laboratory at Peoria, Ill., gets credit for an assist on the early research.

To finance purchase of the Aralac plant and to fill the kitty for substantial capital outlays in the next five years, Virginia-Carolina plans to borrow between $3 and $5 million from bankers. Virginia-Carolina has also bought the remaining 45 percent of outstanding stock in Tobacco By-Products & Chemical Corp. It already owned a 55 percent interest. Total cost of acquiring both the Aralac plant and the Tobacco By-Products & Chemical stock was about $2,950,000.

•

Low cost of styrene monomer has touched off intensified research. Resulting styrene polymer and copolymer plastics threaten older natural and synthetic materials in many fields. And research looks to uses not now possible for other known materials.

Synthetic rubber program of World War II added enormously to production capacity for styrene monomer. This made polystyrene the cheapest thermoplastic. Crystal molding powder sells at 24½c. a lb. So polystyrene plastics are out in front in the field of low-priced thermoplastics for injection molding.

•

Nearest thing to Teflon is a new monochlorotrifluoroethylene polymer. Unlike Teflon, it contains chlorine. Teflon is polytetrafluoroethylene. The new polymer retains almost all the chemical inertness and high-temperature properties of Teflon. Its big advantage: it can be extruded and molded by conventional techniques. Best bets for early application are in wire insulation to withstand high temperatures and in uses where corrosion resistance counts. At least three companies are hard at work on processes to produce the polymer.

•

Fertilizer markets are cutting geographic capers. Demand in the Midwest jumped 36 percent between the last fertilizer year and the current season. Farmers in Dixie, meantime, are buying about 5 percent less fertilizer than they did last year. Fertilizer plants are going up in the corn and wheat belts. Consumption there, almost negligible a few years ago, has now reached about 20 percent of the total for areas where tax tags are sold. For makers of chemicals these shifting fertilizer markets have important geographic implications.

•

Polyphosphates may some day sound the knell of soap in woolen mills. Polyphosphates have slashed soap needs in wool washing by 75 percent, while improving detergency. Use of phosphates in rinse waters is most effective in removing insoluble soaps and pectinates.

•

Competition among the Big Three of fertilizer chemicals is forecast. Fertilizer Association's Maurice H. Lockwood knowingly puts his finger on the frequent changes in relative volumes of phosphate, nitrogen and potash going into mixed fertilizers. Phosphate traditionally dominates the mixed-plant-food business. Phosphate capacity has been upped to record tonnages, now probably exceeding 2.5 million tons of contained P_2O_5 a year. Lockwood thinks more potash and nitrogen fertilizers should be produced too. Unless they take heed, producers of these two chemicals certainly will get less than their share of the farmer's fertilizer dollar.

•

New group of insecticide concentrates made by U. S. I. are the Pyrenones. They are based on piperonyl butoxide and piperonyl cyclonene combined in various ways with pyrethrum or rotenone. The Pyrenones, although lethal to a wide range of insects, are entirely harmless to warm-blooded animals.

•

New amino products plant of International Minerals & Chemical Corp. at San Jose, Calif., is already running above its rated capacity. Kinks in the commercial process, with its custom-built equipment, came out in a surprisingly short time. Largest plant of its kind, San Jose employs 200.

By tank cars from refineries on the western slope of the Rockies and in the coastal area comes the liquid byproduct of the beet sugar industry that is the plant's raw material. Out of it, by a patented process, International makes monosodium glutamate. Unique in its ability to bring out the natural flavor in foods, this amino acid finds a ready market with food processors, hotel men and restaurateurs. International has stepped up its glutamate exports to the Orient, where it is popular in Chinese and Japanese dishes. Also produced are other amino acids for pharmaceuticals.

CHEMICAL ENGINEERING
with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 MARCH 1948 SIDNEY D. KIRKPATRICK, Editor

Can Science Serve Two Masters?

This question had a very thoughtful and thought-provoking answer at the Boston meeting of the National Academy of Arts and Sciences. Speaking of some of the trends that are now disturbing so many of us, President George D. Stoddard of the University of Illinois said: "I believe that science, within the same framework of reference, cannot serve two masters. One of these demands that scientists point their research to preparation for World War III, while the other master is Humanity, seeking permanent peace." How can these conflicting demands be reconciled?

"At present," he continued, "science is serving a master which it cannot control within its own field of competence. What happened in Germany under the Nazis as they mobilized science and technology for their grim purposes is happening now among the chief powers. The technology which is called national defense has crept in as a master and will not be displaced. Any attempt to be free in this area would bring about charges of disloyalty . . ."

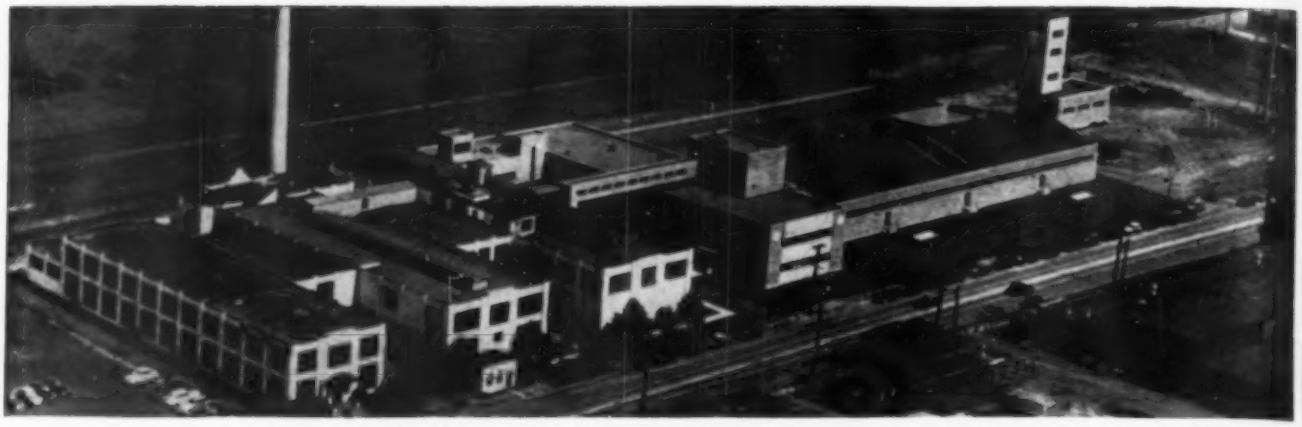
Speaking of the atomic bomb development, Dr. Stoddard declared: "It can be postulated that all nuclear scientists will soon arrive at all the necessary concepts, if they have not already done so. It can be postulated further that a large and resourceful country, such as Russia, will be able to mobilize the men, materials, and ideas that enter into the completed product. An armament race such as is now going on in the field of atomic energy may lead to disaster beyond the powers of description, of which Hiroshima and Nagasaki are but mild precursors."

Granted that the world is facing this gloomy prospect, what can we as scientists and engineers do about it? Are we ready to believe with Stoddard, Noyes and others who have worked with the United Nations' Educational, Scientific and Cultural Organization that the only remedy lies in a world government or in some supreme agency that can direct the discoveries of science toward the advance of world peace? Do we believe that "here indeed is a master before which science can bend, a master for us all, a faith, a loyalty and a new responsibility"?

Or have we been forced so far away from our idealistic concepts of "One World—through Science" that we can no longer hope for a return to the traditional freedoms that scientists have so long enjoyed? Already we are seeing barriers built up between us and our former scientific allies. Even here at home there is a return to "compartmentalization" and more drastic limitations on freedom of inquiry as well as freedoms of expression and communication. The recent semi-annual report of the Atomic Energy Commission and the ominous brakes being put on those who would speed the peaceful applications of nucleonics are almost as discouraging as the daily dallying of the Security Council of the United Nations. Is it any wonder that there is so much less enthusiasm now for unselfish public service on the part of scientists and engineers?

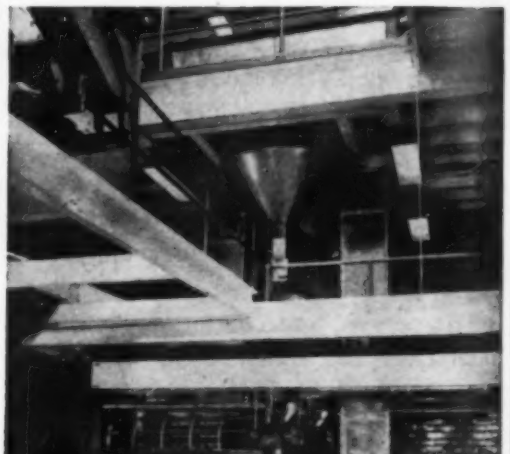
Some of us are not yet ready to accept UNESCO as a practical and realistic solution of this problem. But we want to work for world peace. And we do believe in the basic international freedoms of science. Yet we feel we must not fail in our peculiar obligations and responsibilities to the national strength and security of our country. Surely then there can be an intelligent and benevolently balanced master of science that can capture our energy and enthusiasm, our talents and resources, and direct them to the public good. We suspect that that master must grow and derive strength from a more universal understanding that scientists and engineers are not a strange brood of animals, set apart from all other human beings. Rather, that we want but to be regarded as good citizens and given our chance to contribute our best to both peace and security.

No Headaches Here



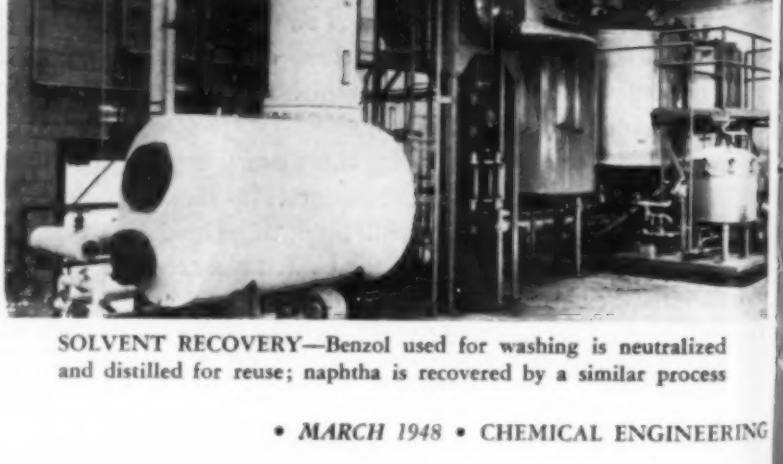
New home for old remedy—Bayer's new aspirin plant in Trenton, N. J.

PROCESSING—From raw materials to pure crystalline aspirin, all accomplished in stainless steel equipment



FINISHING—Mixed with pure food starch, the asperin is pulverized and screened

PILL MAKING—Finished powder is compressed to slugs, reground and retableted



SOLVENT RECOVERY—Benzol used for washing is neutralized and distilled for reuse; naphtha is recovered by a similar process

A Modern Aspirin Plant

RICHARD W. PORTER
Assistant Editor, *Chemical Engineering*

MILLIONS OF HEADACHES ARE REMEDIED BY THE DAILY OUTPUT OF ASPIRIN TABLETS FROM BAYER'S NEW, MODERN MANUFACTURING PLANT

A best seller for years, aspirin is still the biggest in volume of all medicinals. Having pioneered this field nearly 50 years ago, Bayer recently marked a milestone of progress by starting up its new Trenton plant. The new plant embodies every possible feature to insure purity, uniformity and potency. A pictured flowsheet illustrating the various steps of the process appears on pages 136–139.

COMPLETING a transition that started about five years ago, the Bayer Co. Division, Sterling Drug Inc., recently started its new plant in Trenton, N. J. Back in 1942 in an effort to decentralize its operations, and to make room for expansion in other lines, Sterling Drug decided to move its aspirin division from Rensselaer, N. Y., to a new location. The move started in August 1942 when packaging operations were moved to a tract some ten acres in area adjacent to the Pennsylvania Railroad on the north side of Trenton. Little more could be done until war ceased and it was not until September 1945 that construction of a new manufacturing plant was begun.

This new plant was designed to handle the complete processing of aspirin (acetylsalicylic acid) as well as the finishing and packaging operations. Beset with construction difficulties and scarcity of various types of equipment, the $2,500,000 plant was completed last summer and is now in full operation. Several months before starting the processing units, however, all of the finishing operations were gradually brought from Rensselaer to Trenton. Packaging had been in operation since 1942 and the other finishing operations were moved down and started up in the spring of 1947. By so doing it was possible to straighten out all the production difficulties and eliminate all of the "bugs" in the finishing operations before the processing units were begun. Thus, the problem of starting up the plant and whipping it into shape was spread out over a longer period of time and the efficiency of the whole start-up period was improved.

Although the old buildings were remodeled and put to use, several new buildings were constructed to house process units, laboratories and to provide more warehouse space. These steel frame and brick structures are modern in every respect. Continuous bands of glass brick are installed instead of windows, and vapor-proof fluorescent lighting fixtures are used. Each building has its own separate air conditioning system and all air entering the buildings is scrubbed and filtered.

Materials of construction throughout the plant are predominantly stainless steel. That is, every piece of equipment that comes in contact with the aspirin product, including reactors, filters, pipes and even the granulating equipment, is made of stainless steel to minimize possible contamination.

Quality control is emphasized more than any other single phase of operation. Beginning with the raw materials and intermediates and ending with the finished product, more than 70 control tests assure purity, potency and uniformity.

Raw Materials

Only the highest grade raw materials are employed. Before being accepted, each shipment is sampled and subjected to exacting tests to insure Bayer's rigid specifications. Raw materials that react to form aspirin are salicylic acid and acetic anhydride (98 percent). Other compounds used in the process are naphtha (special distilled), benzol (nitration pure), caustic soda, and pure food starch. Salicylic acid, a solid, is received in wooden or fiber drums and is unloaded with a power lift truck and properly stored in the warehouse, as are bags of starch and other supplementary materials. Here, too, is stored the complete line of packaging supplies such as tins, bottles and the variety of cartons and packing cases in which the aspirin is shipped.

Liquid chemicals received in tank cars are stored in underground tanks some distance from the process buildings. Eight such tanks are employed, three of which are built of stainless steel for storing acetic anhydride. The other five are constructed of ordinary steel, two for storing naphtha and three for benzol. Each tank is provided with a liquid level meter whose indicating dial is installed on a wall of the pump house.

Since benzol freezes at about 42 deg. F., it is necessary to heat the tank cars in winter months and it is also necessary to keep the stored material from solidifying. Hot water is circulated through tank coils and through tracer lines along the outdoor benzol piping system. Automatic control of this heating operation helps provide uninterrupted operation. The pump house is located adjacent to the railroad siding and the buried storage tanks. Here are installed stainless steel pumps for unloading the tank cars and for pumping the liquids from storage to the plant. They may be controlled from either the pump house or the processing building. Acetic anhydride is pumped direct to a measuring feed tank located in each of the process buildings whereas naphtha and benzol are pumped to underground storage feed tanks adjacent to the process buildings.

Underground storage is employed

to reduce the hazards of handling benzol and naphtha both of which are extremely flammable. A fire protection system located in the pump house consists of a detection device that controls the discharge valve on a tank of compressed inert gas. If a flash fire should occur, the inert gas would immediately discharge to the atmosphere, blanketing the fire.

Batch Process Used

Bayer aspirin is made by a batch process. Each manufacturing unit, of which there are eight, is comprised of a reaction kettle, primary suction filter slurry wash tank, secondary suction filter and a tray dryer. Two identical buildings each contain four complete units. The process takes four days for completion and each manufacturing unit requires the attention of an operator for a single 8-hr. shift each day. While the plant is operated with full crew only eight hours per day, the process continues through less critical stages during the night with a supervisor to check the operation of vacuum pumps, automatic steam boiler, and air conditioning equipment.

Each agitated reactor is manually charged with a weighed quantity of salicylic acid while acetic anhydride is run in by gravity. The naphtha (used as a diluent) is metered in from measuring tanks. The charging port is closed and the reaction slurry is brought up to acetylation temperature by circulating hot water through the jacket. Acetylation is completed in about six hours. At this time hot water circulation is stopped and cooling by radiation is permitted for approximately three hours. The mass is further cooled by circulating chilled or refrigerated water through the jacket. This continues throughout the night. Temperature is regulated by air operated controllers.

Beginning the second day the slurry of aspirin crystals and mother liquor is blown by means of compressed inert gas to the primary suction filter. Here the mother liquor is filtered off by vacuum and after several hours the crystalline mass is washed with a benzol spray. Mother liquor is collected in a receiving tank in the basement. A separate receiver is used to collect the benzol wash liquor. After washing, the crystals remain in the suction filter overnight.

Inert gas is manufactured by burning ordinary city gas. The resulting product is cooled, compressed and stored at 90 lb. per sq. in. pressure. Pressure is reduced to 20 lb. per sq. in. when used.

Similar to all other process equipment, the filters are constructed of stainless steel. Each filter is about 8 ft. in diameter with a perforated bottom covered with a stainless steel wire screen, burlap and filter cloth. A circular sparge pipe is employed to distribute wash liquor over the filter cake. A low vacuum is used by the suction filter and is supplied by twin rotary units in each of the two process buildings. Filters are equipped with individual ventilating systems that start automatically when the filter covers are opened. This prevents noxious fumes from escaping to the atmosphere. Filters are also equipped with automatic CO_2 fire extinguishers. If a flash fire should occur, CO_2 jets open immediately to blanket the fire.

Crystalline aspirin is transferred from the primary filter to the wash tank where it is slurried with benzol. After agitation for several hours the slurry is blown to the secondary filter where the wash liquor is drawn off and the filter cake rewashed with fresh benzol. Vacuum is maintained on the filter throughout the night and, the following morning, the pure washed crystals are spread on trays and placed in an aluminum cabinet dryer. Drying continues for 24 hr., after which the trays are discharged to drums where the aspirin is held until processed into tablets.

Solvent Recovery

Efficient operation calls for recovery of solvents, namely: naphtha and benzol. Mother liquor is blown from the receiver to a vertical separating tank where, after dilution with water, naphtha separates out. The naphtha-water layer is pumped to a neutralization tank where any acid present is neutralized with caustic soda. This is allowed to settle and the water layer containing neutral salts is drawn off and discarded after which the naphtha layer is passed through a Sparkler filter before being fed to the recovery still. The vapor product is condensed and fed to a decanter where the water and naphtha are separated. Water is sent to the sewer while the naphtha passes through a dryer to remove any moisture present. The naphtha is returned to operating storage to be re-used.

Benzol wash-liquor is blown from the receiver direct to a neutralization tank where, similar to the naphtha recovery operations, the acid present is neutralized with caustic soda solution. Neutral salt water is separated out and discarded and the benzol layer goes through a Sparkler filter and is steam distilled in a fractionator. Benzol-water, as the overhead product, is condensed and decanted. Moisture remaining in the benzol is removed in a dryer and the pure dry product is returned to storage. Bottoms from the reboiler containing some naphtha are sent to the neutralization tank of the naphtha recovery system.

One of the most important features of the plant is the air conditioning system. In the process buildings a complete change of air is accomplished every 3½ min. to remove any noxious fumes that might be present. To check the ventilation system, a gas analyzer installed in each process building, samples air at various critical locations and sounds an alarm if concentration of fumes approaches the lower explosive limit. All outside air entering the plant is scrubbed and filtered.

Finishing Operations

After the dried crystalline aspirin is sampled and tested it is processed along with pure food starch into tablets. Carefully weighed amounts of the two ingredients are dumped into the feed hopper of a bucket elevator that discharges to a ribbon mixer on the floor. After blending, the mixture drops to a hopper and is fed to an attrition mill.

Finely ground powder feeds by gravity to a bolting reel. Material that doesn't pass through the fine mesh is recycled back for reprocessing. From the bolter the powder is carried by screw conveyors to hoppers, each of which feeds a machine that compresses it into 90-grain slugs. These are discharged to drums and then transferred by means of a bucket elevator and a closed conveyor to the adjoining building where final operations take place. Slugs pass through an oscillating grinder where they are reduced to granular form. This is compressed to the finished 5-grain tablets in a battery of machines. Powder is double compressed to provide a tablet of maximum uniformity.

Tablets are collected in control numbered 5-gal. containers and are held in storage for aging before being inspected. Imperfect tablets are removed from inspection belts and the finished tablets go to machines where they are automatically packaged in tins and bottles of various sizes. Bottles are automatically filled, labeled, capped and packaged at the rate of several hundred per minute without being touched by human hands.

Grateful acknowledgement is made to F. H. Merry, J. D. Winig and L. F. Stompf for their assistance and cooperation in the preparation of this article.

A.E.C. Reports Its Year I

CHEMICAL ENGINEERING HIGHLIGHTS IN THE FURTHER DEVELOPMENT OF THE U. S. ATOMIC ENERGY PROGRAM

CHEMICAL engineers will find much of interest in the semi-annual report recently submitted to Congress by the Atomic Energy Commission. Completion of the first year of control under the Atomic Energy Act of 1946 finds under way a multimillion-dollar program for expansion and improvement of all facilities. Modernization of the Hanford (Wash.) plant for plutonium production is referred to as "one of the largest construction programs ever undertaken by the government in peacetime." Research, both fundamental and applied, has been reorganized and expanded with the Commission executing more than 100 research contracts and subcontracts and also inaugurating a $90,000,000 plan for providing new research facilities. Continued production and distribution of isotopes promise greatly expanded use of these important research tools. Within the year the commission appointed and activated a dozen representative advisory committees on raw materials, biology and medicine, isotopes, contractual relations, safety and health, scientific personnel, security and industrial relations.

Some significant chemical engineering highlights in the Commission's report for its first year follow:

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Production—Immediately prior to the transfer of its properties to the Commission, the Manhattan Project started reducing the scale of operations at the Oak Ridge Electromagnetic Plant and at the same time greatly stepped up production at the Gaseous Diffusion Plant. While much of the production equipment in the Electromagnetic Plant is maintained in standby condition, its powerful magnets and research facilities are used for limited production and process improvement purposes.

Plutonium production facilities at Hanford "are being substantially expanded, taking into account both new developments and the normal deterioration and obsolesence of this type of facility." The General Electric Co., contract-operator of the Hanford Works, also has the prime contract for the construction program which will require an even greater expenditure of funds than the original building of the plant (approximately $342,000,000). G. E. has mobilized strong technical and construction staffs and under some difficulty has organized the procurement of many non-standard items of equipment needed.

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Raw Materials—Also revealed for the first time in AEC's new report is the fact that present production is based almost entirely on imported uranium ores. Imports are now sufficient to supply the Oak Ridge and Hanford plants and also to accumulate a stockpile against any interruption of foreign supplies. Wartime facilities for extracting uranium from tailings of domestic vanadium works at Durango, Uravan, and Naturita, Colorado and at Monticello, Utah, have been abandoned. However, the Commission plans soon to start experimental extraction of low grade domestic ores at Monticello.

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Quality Control—Since the materials used, at every stage of the production process, must be of a purity never before achieved outside the laboratory, an elaborate system of quality control and specification testing is necessary. A great variety of new instruments has been developed for these purposes and for the detection of radiation, many of which are now proving useful in other kinds of industries and laboratories. To insure a continuing supply for the Commission's work and for others, the manufacture of these instruments is being licensed to commercial firms wherever security considerations will permit.

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Research on Reactors—Research and development on nuclear chain reactors is shaped by three primary considerations: (A) requirements of the military establishment, (B) reactors for research and development purposes, (C) special large scale industrial applications. This work involves study of the following materials:

1. Fuel elements
2. Moderators required to slow the neutrons in reactors utilizing low energy neutrons
3. Coolants required to remove the the heat generated by fission within the pile
4. Structural materials which form the supporting framework of the pile
5. Shielding, required to confine the intense radiation
6. Auxiliaries, such as pipes, valves, blowers, pumps, instruments and controls, feeding and removal mechanisms, protective casings for feed materials.

Sufficient research progress has been made on a number of these problems to permit the design of medium high temperature reactors using various coolants and with several variations in the moderator. These reactors may be operated at temperatures high enough to produce power on an experimental basis. One of such reactors should be in operation by the end of 1950, and perhaps earlier.

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Fuel "Breeding"—Discussed openly for the first time in this A.E.C. report is progress made in the development of a nuclear reactor for much more efficient utilization of the available fissionable material. One important line of work in this direction is the "breeder" type of reactor which over a period of time will actually create more fissionable material than is put into the reactor as fuel to sustain the reaction. If this can be worked out the supply of atomic power will not be limited by the tiny fraction of uranium which occurs in the readily fissionable form, U235. This means that some day all of the world's uranium, as well as its thorium, may be available as a source of atomic energy. Thus a tremendous military as well as industrial potential is involved in solving this problem.

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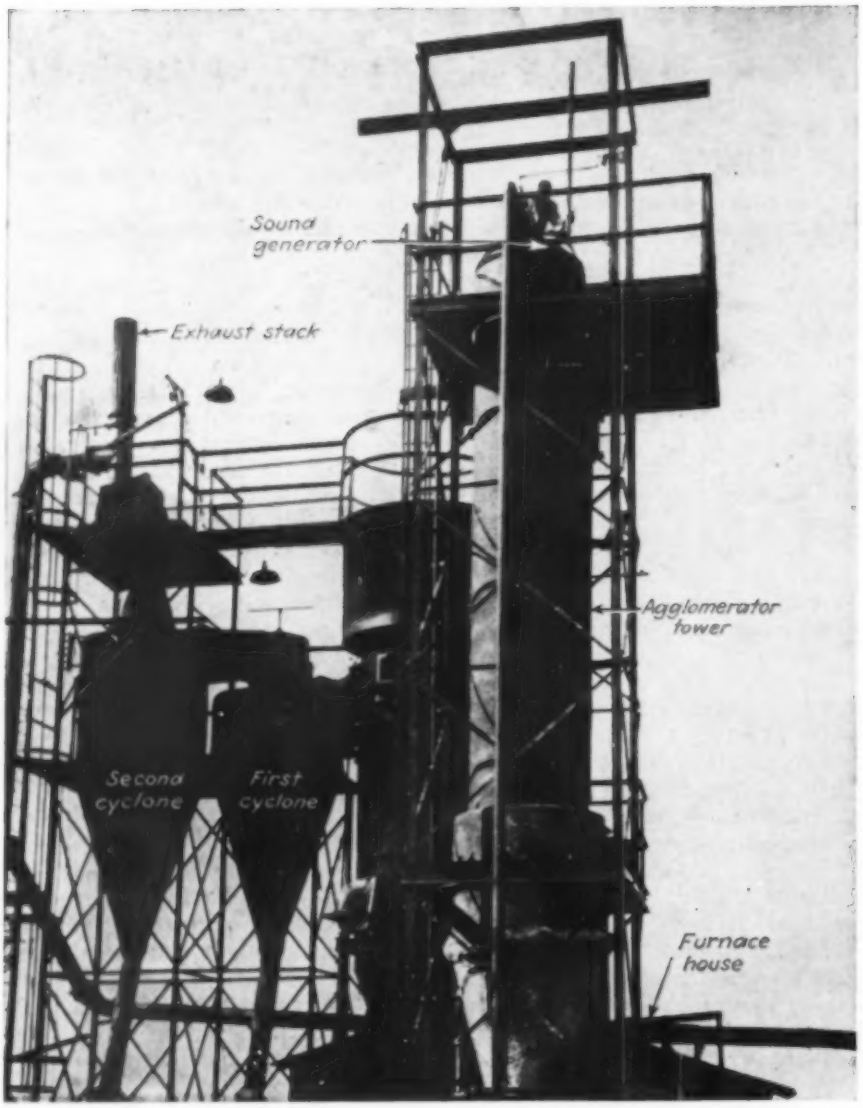
Atomic Power—The development work to be done on reactors and the periods of time required to produce usable amounts of new fuel through "breeding" introduce a time factor "measured in years as to when nuclear energy can make a significant contribution to the supply of power now available from other sources." The Commission holds that the prospect is an encouraging one, but "the timetable extends through two decades."

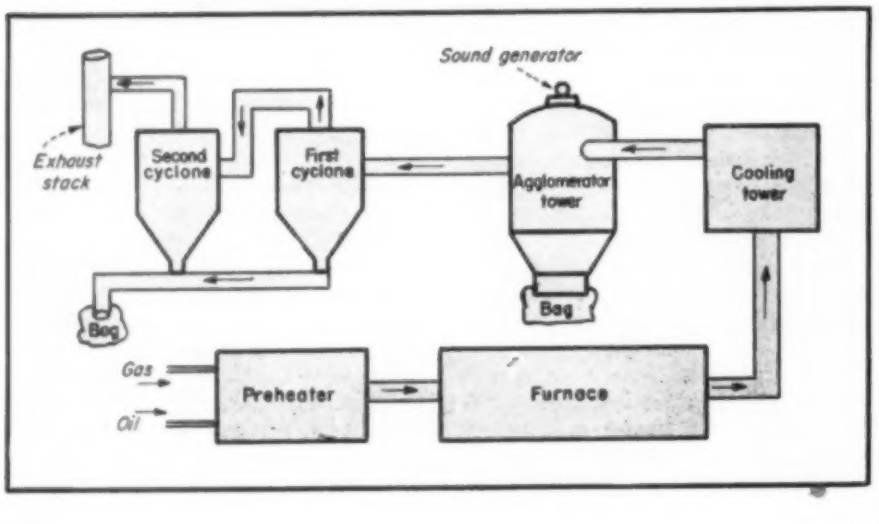
High Intensity Sound Wave

RICHARD W. PORTER
Assistant Editor, *Chemical Engineering*

Until recently, the use of high frequency sound waves was restricted because of their low intensity. *Now,* ***however, the powerful new sound generator made by Ultrasonic Corp. has made possible large scale applications. Most important of these is dust and aerosol collection where this new method should prove valuable to a wide variety of industries.***



PILOT PLANT—Fine particles of furnace black are agglomerated with sound waves and removed from the gas stream by cyclone separators; this unit handles about 2,000 cu. ft. per sec. of flue gas; Below—Flow diagram of the process



FOR MANY years scientists have realized that sound, if effectively harnessed, could be an extremely versatile industrial tool. But only in recent years has this versatility begun to take form. Now, after years of research and study, utilization of sound has emerged from the laboratory and is taking its place in industry.

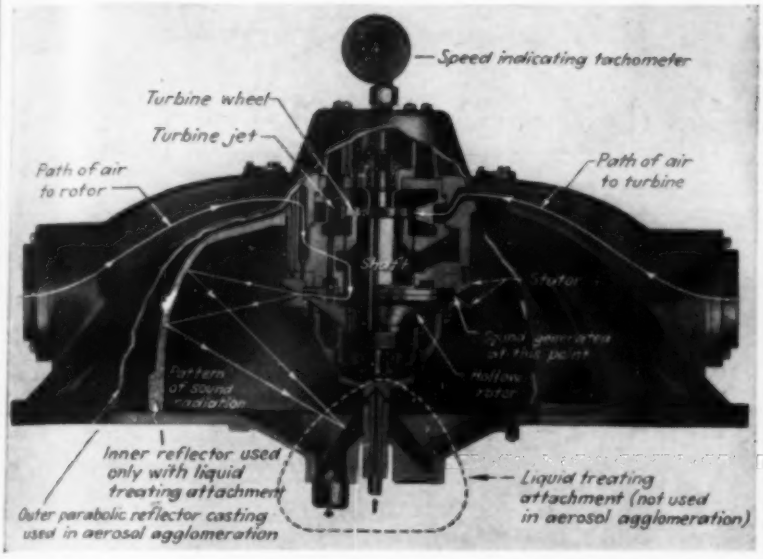
So far, most applications of sound waves have been accomplished with high frequency, low intensity vibrations produced by quartz crystals or by electromagnetic oscillating diaphragms. Such vibrations are used for sonar detection in submarine warfare, small scale liquid emulsification, detection of flaws in metal parts and castings, thickness measurement of pipes and tanks and a variety of other applications.

Now the spotlight is on high intensity sound. Produced by the powerful new generator made by Ultrasonic Corp., Cambridge, Mass., high intensity sound waves appear to have many potential large scale applications.

Biggest single potential to date is aerosol agglomeration. Laboratory and pilot plant studies have shown that practically any smoke, mist or dust can be effectively recovered with the new sound machine. So promising is this application that a number of firms in a variety of process industries have placed orders for this high intensity sound equipment.

Basically, sound consists of a series of pressure variations or alternate in-

Now Harnessed For Industry


Speed indicating tachometer
Turbine wheel
Turbine jet
Path of air to rotor
Path of air to turbine
Shaft
Stator
Pattern of sound radiation
Inner reflector used only with liquid treating attachment
Outer parabolic reflector casting used in aerosol agglomeration
Liquid treating attachment (not used in aerosol agglomeration)

SOUND GENERATOR converts over half the energy in compressed air to sound; different reflectors may be used for different purposes

EXTENSION REFLECTOR is used with the sound generator for experimental fog dispelling

creases and decreases in pressure. They are actual physical vibrations or pulsations and are transmitted in gases, liquids or solids. Unlike radio waves, sound can't be transmitted in a vacuum.

Frequency or pitch is determined by the number of pulsations and expressed in cycles per second. The human ear can pick up sound from about 500 up to 15,000-18,000 cycles per sec. Sound frequencies above the range of human perception are generally known as ultrasonic.

The second variable in sound is intensity which is measured in decibels. Zero decibels is the lowest level of hearing whereas higher than 120 decibel sound is painful to the human listener. Intensity and frequency can be considered to vary independently since sound with a given frequency can have almost any intensity and vice versa. Limit of audibility is fixed by the frequency or pitch not by intensity. Therefore, no matter how loud a sound is, it can't be heard unless it is in the audible frequency range.

Different characteristics of sound waves provide the basis for different types of uses. First of these is that they are actual physical impulses. On this phenomena are based such applications as aerosol agglomeration, and liquid emulsification. The second characteristic is that sound waves travel at different speeds in different media. This permits the use of sound waves to identify and distinguish individual materials. A third property of sound waves is that they are reflected by surfaces and discontinuities. On this property is based the various sonic instruments for flaw detection, thickness measurement, etc.

Sound Makers

In general there are three types of sound generators in commercial use. Two of these use electrical energy as a source of power while the third uses compressed air.

Most common method is to pass high frequency alternating current through a quartz crystal which then expands and contracts at a high frequency. In a somewhat different manner, alternating current is run through a coil of wire wrapped around a metal bar which expands and contracts in the alternating magnetic field. When attached to a metal diaphragm this unit produces high frequency sound waves. Both these ultrasonic units are used in instruments and detecting devices and also find application in laboratory and small scale liquid processing. The main limitation of these units is that they cannot deliver high intensity sound and are consequently limited to applications where only low power is required.

Newest sound generator is the siren type unit designed and built by Ultrasonic Corp. The generator is essentially a high speed air siren driven by a variable speed air turbine. Compressed air passes into a rotating hollow disk, then radially outward through slots on the periphery past stationary vanes which cut it into short pulses. The pulsations or vibrations are focused by horns in the stator to a reflector which further directs the vibrations as required by the application.

Frequency of the sound waves for a given machine is determined by the speed of rotation. Intensity is determined by the amount of air forced through the generator. With this type of machine both frequency and intensity are easily varied. The standard unit operates over a frequency of 1,000 to 200,000 cycles per sec. with intensities from about 100 to 170 decibels. From 50 to 70 percent of the energy in the compressed air is converted to sound energy.

For aerosol collection, the sound generator is mounted atop a vertical tank or tower and the sound vibrations reflected downward. In fog dispelling experiments, an extension to the parabolic reflector is employed. For experimental work in treating liquids, a special "liquid curtain" attachment has been developed.

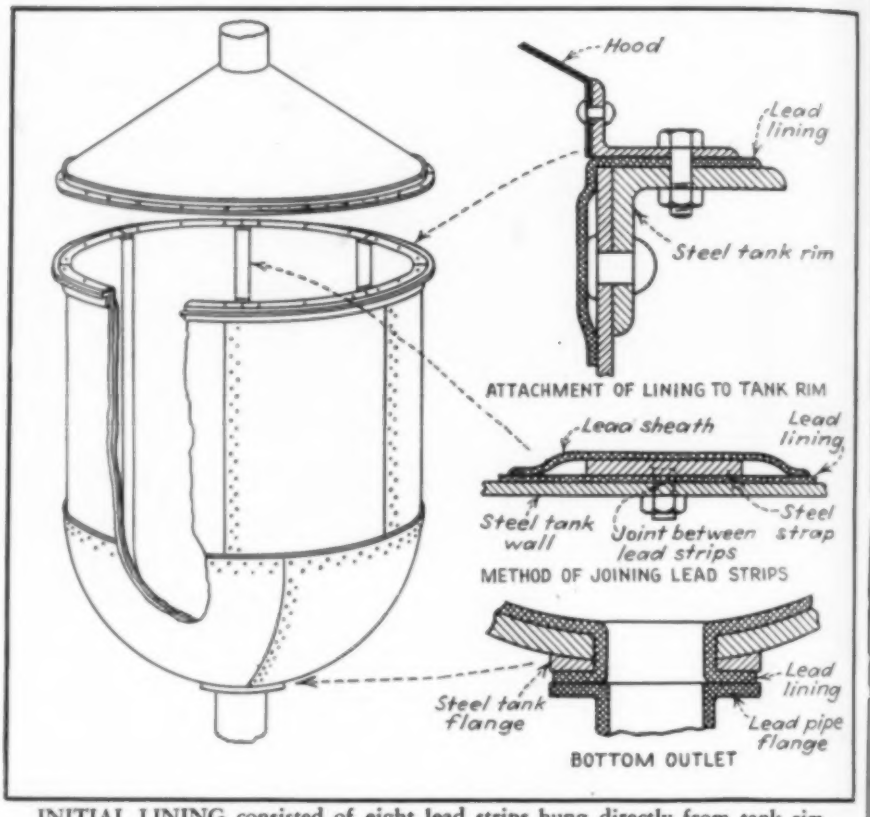
Aerosol Agglomeration

With its high power sound generator, Ultrasonic Corp. set out to invade the dust recovery field heretofore dominated by such equipment as electrostatic precipitators, scrubbing towers

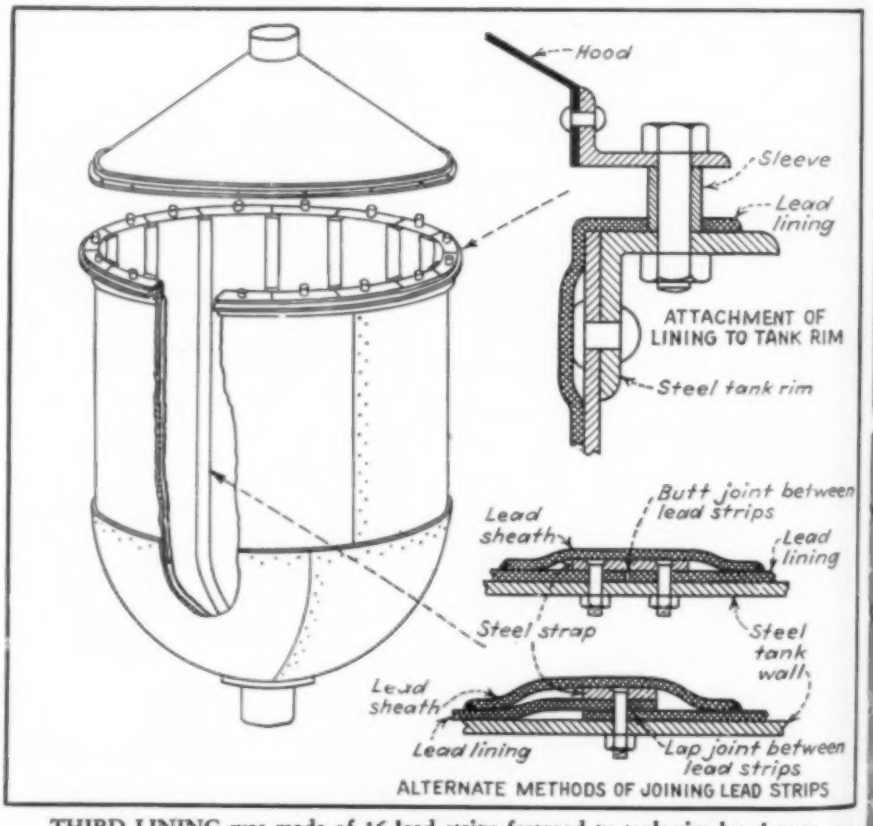
(*Continued on page 115*)

Resistant Lining fo

Failure of lead linings in alum boiling tanks led engineers at the Baltimore Bureau of Water Supply first to modify construction details in the lead-lined tanks and then to experiment with a new lining. This lining consists of a thermoplastic, non-porous, flexible membrane bonded directly to the steel tank wall and faced with acidproof brick. It promises to last twice as long as the lead lining. Its cost per ton of alum produced should prove less than one-fourth that of the older lead lining.



INITIAL LINING consisted of eight lead strips hung directly from tank rim



THIRD LINING was made of 16 lead strips fastened to tank rim by sleeves

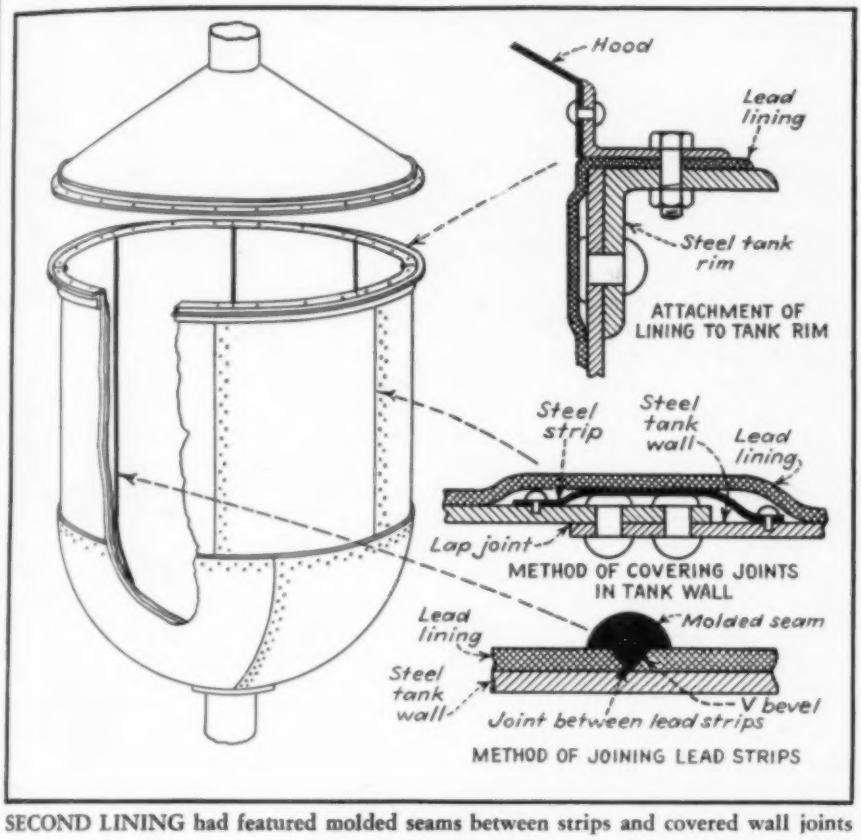
LIQUID alum is made at the Montebello filtration plant of the Baltimore Bureau of Water Supply by reacting bauxite and sulphuric acid in lead-lined steel tanks. Originally installed in 1928, these tanks have been relined on two occasions, once in 1932 and again in 1938. At each relining Bureau of Water Supply engineers sought to improve the lead linings by introducing various modifications in their construction. All modifications failed to give completely satisfactory service. Accordingly, in 1946 it was decided to try instead a lining consisting of an impervious membrane bonded to the steel walls of the tank and faced with chemical brick. Its subsequent performance has demonstrated its superiority over the lead lining for this application.

Making Alum

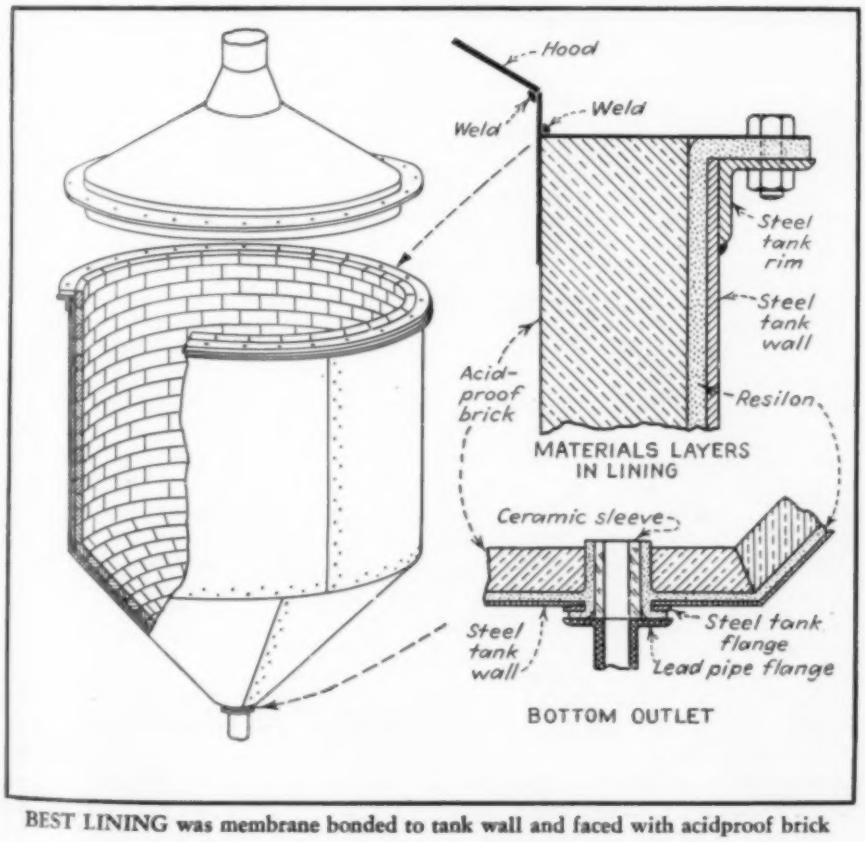
The liquid alum produced at the Montebello filtration plant is used there as a coagulant in water purification. Alum manufacture by the Hoover Process[1] began at Montebello in 1928. The Hoover process is distinctive in that it does not require steam or other auxiliary heat, the conversion to alum being solely dependent upon the heat of reaction of the sulphuric acid and bauxite. Another unusual feature is that insoluble silicates are retained to serve as added nuclei for colloidal conglomeration in floc

Alum Boiling Tanks

EDWARD S. HOPKINS
Associate Engineer
Bureau of Water Supply
Dept. of Public Works, Baltimore, Md.



SECOND LINING had featured molded seams between strips and covered wall joints



BEST LINING was membrane bonded to tank wall and faced with acidproof brick

formation. It is further to be noted that the alum is not crystallized.

Eight tons of alum is made in each batch. Approximately 3,650 lb. of water is admitted to the tank, followed by 8,780 lb. of 60 deg. Bé. sulphuric acid. Fifteen minutes is required to run the acid into the tank, during which time the temperature of the liquid increases from 65 to 125 deg. F. Next 4,180 lb. of powdered bauxite, fine enough to pass through a 200-mesh sieve, is charged into the tank during a 10-min. period. Slight agitation is applied to the mass by the use of compressed air. The admixture remains quiescent for 15-20 min., then the temperature of the mass rises rapidly to 235 deg. F. Violent boiling with considerable discharge of steam continues for about 30 min. with the liquid surface close to the top of the tank. When it reaches the level at which it almost overflows the tank, the liquid is cooled by spraying its surface with cold water for a few seconds. This causes the level to drop 4-6 ft. This spraying with cold water is necessary three or four times during the digestion. After boiling 30-40 min. the liquid slowly subsides to a depth of 5 ft. with a slight drop in temperature. This indicates that the reaction has been completed.

Dilution Rate

Originally, each boil was quickly diluted after the reaction had been completed. As an effort to minimize cracking of the lead lining, however, dilution rate was later controlled so that the solution temperature was lowered at a rate of 1 deg. F. per min. About 1½ hr. is required to fill the tank, giving a 10 percent alum solution. Upon dilution the liquid is equalized by violent air agitation for 10 min.

Three steel tanks, each holding 19,800 gal., were originally installed. Fifteen feet in diameter, each tank is 17½ ft. high, with 10-ft. cylindrical top and 7½-ft. hemispherical bottom. The plates are ¼ in. thick, with lapped joints secured by a double line of ¾-in. rivets. Support is given by steel columns riveted directly to the tank

wall. The rivets on the inside are flattened but not countersunk. The lead lining is carried through the bottom outlet. This outlet is flanged. Bolted directly to it is the flanged lead pipe supplying the operating tanks. To remove dust, steam and fumes, the tanks are covered with conical steel hoods connected to 20-in. diameter vent pipes leading to the roof. The hoods and vents are made of 14-gage steel, protected on the inside by bitumastic enamel applied hot.

Initial Lining

Each tank was initially lined with eight strips of 10-lb. sheet lead, $\frac{3}{16}$ in. thick. These sheets were of "orange peel" design, 5½ ft. wide at the top and tapering to 1¾ ft. at the bottom. They were hung directly from the top rim of the tank. A hood, made of plates of 14-gage steel, for the removal of fumes, was bolted directly to the lead sheets, resting on the tank rim. The bottom edges of the "orange peel" sections were burned directly to the 10-lb. lead disk, 5 ft. in diameter, forming the bottom lining. Over each joint between the lead strips was bolted on 18-in. centers a steel strap, 3 in. wide and ¼ in. thick, extending practically the length of the tank. This was to keep the lead sheets against the steel shell, thus preventing vertical or lateral movement. The edges of these straps were not beveled. Each strap with its bolt heads was covered with a 10-lb. lead sheath burned to the tank lining.

Armstrong's Observations

In his discussion[8] of this original lining, James W. Armstrong, who was filtration engineer in charge of the Montebello plant when the alum manufacturing program was instituted and who designed the original tanks, states:

"It was anticipated that occasional trouble with the lead lining might permit acid solutions to get between the lead and the steel. In order to detect any such leaks, the joints in the steel work were left uncaulked and a number of holes were drilled through the steel section of the tank bottom. These precautions proved valuable in detecting leaks but they offered little indication as to their position. This could only be learned by a careful inspection of all lead surfaces. The first cracks discovered in the lead were very small, but as time went on they increased in size and the difficulty of making satisfactory repairs became greater.

"For a period of nearly two years the lining was in every way satisfactory, but after that time slight leaks began to appear, which grew steadily worse until they caused much trouble of an exceedingly aggravating type.

"Careful inspection revealed the fact that most of the trouble occurred where the steel plates of the tank lapped, or along the edges of the vertical strips of lead. The latter covered the steel strips that were used to hold the sheet lead in place.

"Invariably the deepest and most pronounced cracks were on the concave or compression side of the plate, the place where they were least expected. Apparently the sheet lead expanded and buckled under the influence of heat. Following the line of least resistance, it started to bend at the places where there was an offset in the steel tank or where the rigidly secured steel plates resisted the movement in one direction. The buckling caused compression in the extreme fibre on the concave side, and when the tank was filled, the pressure of the liquid forced the lead back again against the side of the tank, but as lead under stress apparently does not expand and contract in accordance with Hooke's law, the continued expansion and contraction caused a more or less crystalline condition, especially where the compression was greatest, until the metal lost its ability to resist tension."

With the lead sheets fastened to the tank rim by the hood and the vertical joints held firmly by the bolts on 18-in. centers, expansion under rise of temperature resulted in buckling of the sheets at intermediate points. This was greatest in the hemispherical bottom. After the lead had lost its elasticity, these bulges developed appreciable cracks through which the acid solution penetrated to the steel shell.

Second Lining

In 1932 the tanks were relined. The eight strips in each tank were of the same size as the originals, but 20-lb. lead, ¼ in. thick, was used this time. These sheets were hung directly from the top rim without fastening to the side wall. Their bottom edges were burned directly to the 5-ft. disk forming the bottom lining. The steel hood was bolted directly to the lining and rim as in the previous installation. The side edges of the lead sheets were beveled to form a V and then joined by a heavy molded seam so as to give a monolithic lining. To provide a smooth surface and to reduce bending over the lap joints and rivet heads of the tank wall, strips of 20-gage steel, 12 in. wide, were fastened with drive screws over these joints and rivets. The several vertical lap joints in the tank wall and the circumferential seam joining the hemispherical bottom to the side wall were thus covered.

Hair cracks developed in each of the linings after two years of usage and the sheets sheared off circumferentially near the top, resting finally against the tank wall with placement maintained by their own weight and rigidity. After the lining had broken free from the steel shell at the top of the tank, it next exhibited appreciable cracks and buckling over the area of the hemispherical bottom. There was no relation between these cracks and the position of the tank plate rivets, showing that the 20-gage steel strips were of value. Extensive cracks, usually directly through the weld, also developed in the molded joints between the sheets. Failure, in terms of requiring repair by the lead burner after each batch made, occurred after four years of service.

Since replacement of the lead linings was not undertaken immediately, the constant corrosion of the steel bottoms required their renewal. This was accomplished by butt-welding new plates on a 10-ft. circle before relining in 1938.

Third Lining

In the 1938 relining operation the 20-lb. lead sheets were again used, but the "orange peel" was reduced to a width of 2¾ ft. at the top, requiring 16 strips. Two tanks were lined with chemical lead, one with butt joints, the other with 3-in. lapped joints. The third was lined with tellurium lead and butt-jointed. The sheets were held in place by the lead-covered steel straps as in the original installation, except that the bolts were placed on 6-in. centers and staggered on either side of the butt joints. They were centered in the lap joints. These straps were covered by 10-lb. lead sheaths burned to the tank lining. The hood was no longer bolted directly to the lining and tank rim as in the previous installation. Instead the hood was bolted to 1-in. sleeves, ¾ in. in diameter, which passed through the lead lining to the tank rim. This design permitted the sheet to expand with rise in temperature.

Although installed with the expectation that they would become toughened at deformation points by alternate expanding and contracting action, the tellurium-impregnated sheets did

not give longer service than the chemical lead. Lapped joints in one of the tanks lined with chemical lead were not superior to the butt joints. Although fastened on close centers to the steel shell, the lead lining expanded during digestion of the alum, rising vertically from ¼ to ½ in. on the sleeves supporting the hood. This was difficult to understand until the lining was removed, when it was discovered that all of the bolt holes had become elongated, thus allowing this movement. Principal failures occurred at the joints between the lead sheaths over the steel straps and the lead lining itself and also at the joints between the "orange peel" sections and the bottom disk. Cracks in these places permitted the acid solutions to get under the lining and perforate the shell. The lead sheets buckled extensively in the hemispherical bottom section, with subsequent development of extensive cracks and penetration by the acid. After seven years of continuous use one of these tanks failed. The other two will require replacement of their steel bottoms.

Service

The quantity of alum manufactured in each of these tanks during its useful life was very consistent for all tanks. Each tank turned out about the same number of batches. The three tanks together, as originally lined, produced 472 batches in the first two years and 940 batches before they failed. After the second linings had been installed the three tanks made 450 batches of alum in two years and 843 batches before failure. With the third series of linings in place, the three tanks produced 488 batches in two years and 1,163 batches before failure.

Causes of Failure

Inability of the lead sheets to obey Hooke's law when under stress with a resultant crystalline condition at the point of shear was, according to Armstrong in his paper, the principal cause of failure. Actually, the fact that the lead expands more than the steel for a given temperature increase was a serious factor. The ratio of the linear coefficient of expansion of lead to that of low carbon steel is about 2.5 to 1 (lead, 15.71×10^{-6}; low carbon steel, 6.36×10^{-6} per deg. F. at room temperature). With the lead lining fastened to the tank at many points, a system of expanding and contracting grids was established that localized the deformation of the lining and reduced the buckling to a series of small areas. This was particularly noticeable wherever there was an offset, such as a rivet head or lapped joint, in the steel shell. This movement produced the initial hair cracks after two years of service. With subsequent usage these were enlarged, forming appreciable openings in the sheets or in the lead sheaths covering the steel straps, and thereby permitting penetration of the acid or alum solution to the steel plates.

Metal Fatigue

It is apparent that final failure of the lead as a protective lining was due to fatigue of the metal. Since the elastic limit, as permanent elongation, is 0.005 percent, it is believed that with an area of 825 sq. ft. per tank this limit is reached in the 150-160 batches manufactured in the initial two-year period. Additional use causes the metal to become brittle, with subsequent failure after 300 batches.

Consideration was given to facing the existing lead lining with acidproof brick. This was considered impractical, however, as these bricks are not completely impervious and, should a leak develop in the lead lining, perforation of the steel might occur at any point due to seepage between the lead lining and tank wall.

Brick-Faced Impervious Membrane

In 1946 it was finally decided to abandon lead lining for this purpose. One of the three tanks was replaced by a butt-welded steel shell, ¼ in. thick, of the same general dimensions as the other tanks, but with a conical bottom instead of a hemispherical one. All welds were ground smooth on the inside. The new tank was welded to the supporting columns. The inside steel surface of the new tank was given a primer coat of paint containing synthetic resins. Next, sheet Resilon, ½ in. thick, was bonded by heat directly to the inside of the steel shell. This material, with a synthetic resin base, contains magnesium silicate and a chlorinated hydrocarbon. It forms a thermoplastic membrane which is non-porous and flexible. It will not sag at 170 deg. F. and is unaffected by abrupt temperature changes, contracting and expanding with the steel shell. Its dielectric strength is equal to that of hard rubber. The material has resistant properties comparable to those of rubber. It is suitable for use with dilute sulphuric acid and acid salts.

The membrane was faced with acidproof brick. Standard acidproof bricks, each 4½ in. thick, lined the side wall, while the same material in special shapes was used in the bottom. These bricks are dense, vitreous, strongly resistant to acids, with but slight porosity. They are manufactured for use at temperatures not exceeding 300 deg. F. Vitric-10, a quick-setting silicate cement, acidproof, was used to hold the bricks in place. This cement is inert to all acids except hydrofluoric, and it is a satisfactory binder at temperatures up to 750 deg. F. Prior to use, bricks and cement were hardened by curing with a 2 percent sulphuric acid solution for 24 hr.

To protect the bottom outlet, a ceramic sleeve was cemented to the bottom bricks and extended through the steel shell to the flanged lead pipe leading to the operating tanks.

The hood for fume removal was bolted directly to the rim of the tank with the bolts passing through the thermoplastic membrane.

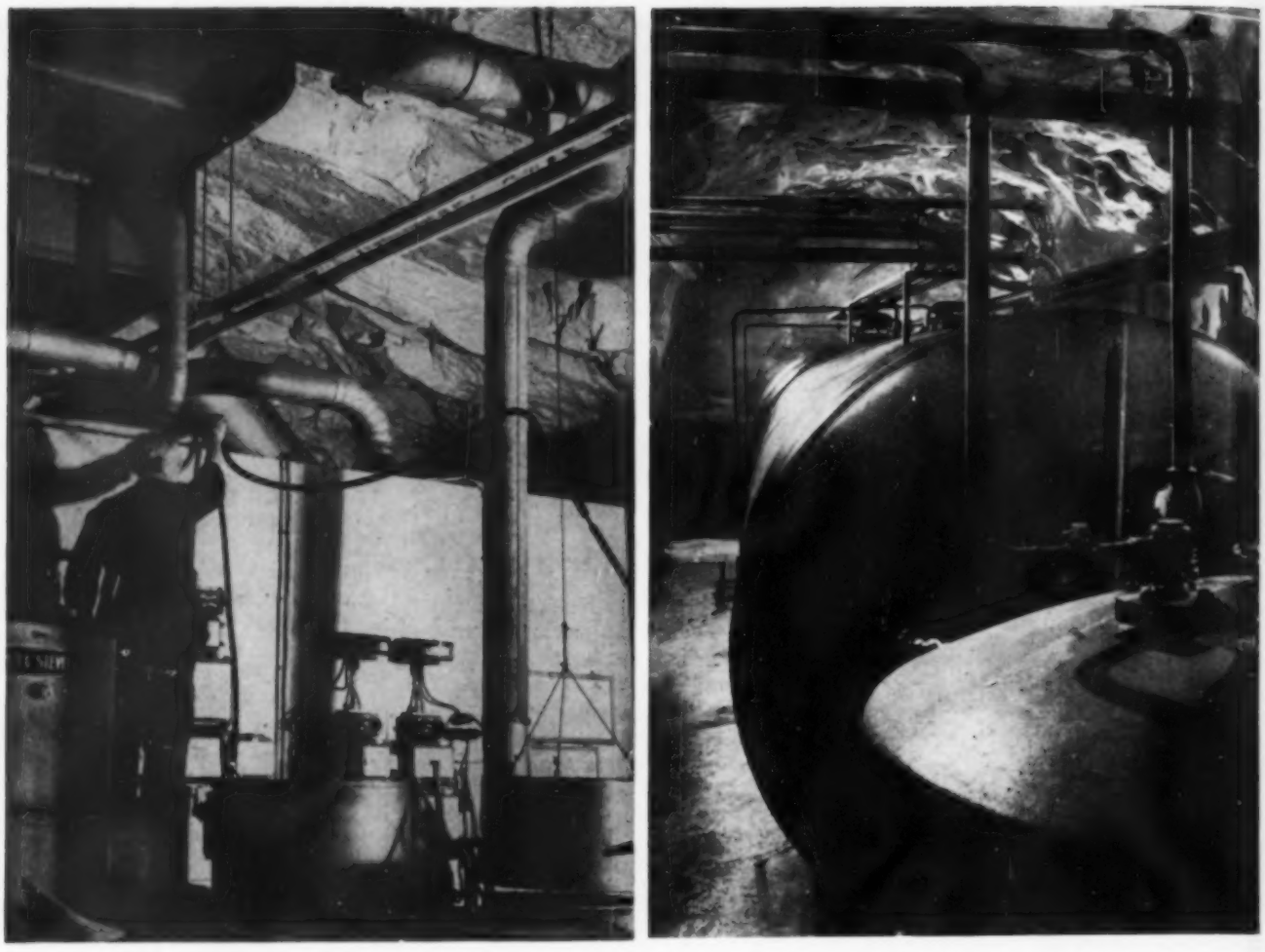
A rough measurement of the tank wall temperature during the alum digestion showed an increase of only 7 deg. F. from 86 to 93 deg. F. Expansion of the steel is negligible and the membrane cushion prevents fracture of the bricks. Each material layer functions as a separate entity.

Demonstrated Superiority

The chemical brick-impervious membrane lining has been in service five months and 132 batches have been made in the tank without any indication of deterioration. This is equivalent to the number of batches that can be made in a lead-lined tank before the point of loss of elasticity is reached. Although expected to give "indefinite" service, it is practical to amortize this bonded lining over a 10-yr. period. If production of 2,700 tons, or 340 batches, of alum per year is taken as a basis, and if a useful life of five years is assigned to the lead lining and ten years to the chemical brick-impervious membrane, the cost is $1.41 per ton of alum produced for the lead lining and 32c. for the chemical brick-impervious membrane. Thus the latter has demonstrated its superiority.

Detailed observations concerning the behavior of the lead sheets were reported by A. A. Bailey, junior associate engineer of the Baltimore Bureau of Water Supply. Both Leon Small, water engineer of the Bureau, and Nathan L. Smith, director of public works, concurred in the decision to adopt the bonded lining.

1. Hoover, C. P., U. S. Patent No. 1,197,123.
2. Armstrong, J. W., *Civil Engr.*, **3**, 168 (1933).



Taken in an aircraft engine plant, these pictures illustrate the type of equipment installed underground in Sweden.

Can Chemicals Dig In?

G. A. VAN BRUNT
Associate Editor, *Factory Management and Maintenance*

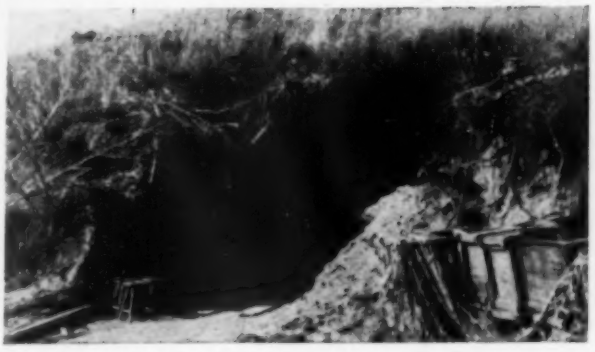
SURVEY OF UNDERGROUND PLANTS IN OTHER NATIONS FINDS CHEMICAL PLANTS CAN GO BELOW SURFACE AT HIGHER COST

German and Japanese industry was moving underground when war ended. Other nations were burrowing too, including Sweden and Britain. The passive defense measures proposed for protection of United States industry from future atomic bombing includes building plants below ground level. To determine the practicality of this, McGraw-Hill editors surveyed the existing information. Here is a summary of the results of the survey as applied to chemical manufacturing plants.

NEW BOMBS and methods of bombing, the current hostilities throughout the world, and the so-called "Cold War" all indicate the necessity of national preparedness. As part of the defense preparation of the United States, protection of plants from destruction by enemy bombs ranks high. To determine the practicality of one protective measure, a committee of McGraw-Hill editors has assembled the available evidence on the construction of plants underground. Although the evidence is not conclusive, the practicality of such

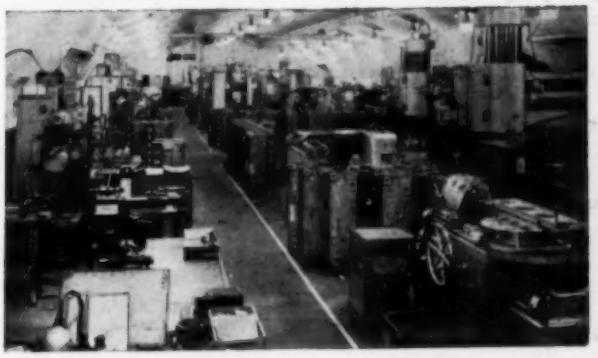
A STUDY IN CONTRAST—

Frantic Japan



The Japanese, harried by U. S. bombers, merely rushed equipment into every available cavern. Factories were poorly designed, corrosive to equipment, uncomfortable

Calm Sweden



The Swedes, worried but at peace, took their time and designed finished installations. This Bolinder-Munktell plant at Eskilstuna shows what can be done underground

construction seems definite. The economic picture is less clear.

Among the nations that built underground plants are Japan, Germany, Italy, Czechoslovakia, neutral Sweden, and allied Britain. Germany had as many as 143 such plants in operation by V-E Day. With the exception of Sweden, these plants were for the most part make-shift. Only Germany attempted the construction of underground chemical plants. Most of the factories built were of the light fabrication and assembly type.

German Attempts

The Nazis made strenuous but belated attempts to move their chemical and petroleum industries below ground. A total of 23 plants were planned. They were not started until 1944, however, and little production was realized from them before the war's end. The Germans planned factories for coal hydrogenation, catalyst manufacture, diethyl benzene, oxygen, tetraethyl lead, and V-2 rocket fuel production. Refinery equipment located underground included such units as hydroforming, catalytic cracking, alkylation, lube oil distillation, furfural treating, paraflow, and hot clay contact.

Most of the German plants were located in tunnels. The only reported construction in a natural cave housed the tetraethyl lead plant. Located near Brixlegg in the Austrian Tyrol, the cave was large enough to accommodate a commercial plant of conventional design and construction. Equipment was just being received at the end of the war.

The most ambitious German plant was designed as a permanent installation. This was the Dachs No. 1 plant at Porta, Westphalia. A lubricating oil distillation and treating plant, it was located in tunnels dug out of sandstone. The equipment consisted of a two-stage vacuum distillation unit taking three side cuts on the first stage and one on the second stage, a furfural treating plant, a hot clay contact plant, and a dichlorethane dewaxing plant.

Construction began on the tunnels in July 1944, and the installation of equipment started in September. At the termination of construction in March 1945, the plant was only 80 percent complete.

Steam was provided by two 600 psi. boilers having a capacity of 65,000 lb. per hr. The electric demand of 3,000 kw. was brought in by underground cable. Transformers, which German experience showed are extremely vulnerable to bombing, were located underground. Cooling water was provided by four centrifugal pumps located in two separate concrete pump houses on the banks of the Weser River. Pumps were installed in a pit about 20 ft. deep. The output of one pump house would supply adequate water except in midsummer.

Ventilation

Ventilation was provided to reduce the hazard of explosive mixtures. There were four main tunnels, and the ventilating system consisted of blowers located at the rear end of two of the tunnels. Air was drawn in through the transportation and tank tunnels and exhausted through the two plant equipment tunnels. Furnace rooms and ammonia compressor rooms were

ventilated separately and isolated from the remainder of the system.

Underground tanks were provided in the tunnels for all unfinished products. These were constructed by lining the tunnel walls and floors with brick and concrete and installing bulkheads of reinforced concrete to divide the tunnels into separate tanks.

Large Plants

The size of some of the German installations is indicated by the plant built at Niedersachswerfen, near Nordhausen in the Harz Mountains. A fertilizer company had been mining gypsum stone in an open cut since 1918. In 1936 the German government ordered a change to underground mining, the tunnels and chambers so produced to be used for storage. Within 13 months chambers 1 to 17 were excavated, and four months later were finished. Each of the chambers is about 20 ft. high, 30 ft. wide, and 550 ft. long. These chambers were used by Junkers for an aircraft plant.

Chambers 18 to 45 were begun in September 1943, to be used for V-bomb production. These chambers were of circular cross-section with a 38 ft. diameter and were 550 ft. long.

The next nine chambers were to house units for coal hydrogenation, catalytic cracking, hydroforming, and alkylation. Production would include aviation gasoline, heating oil, and propane. The chambers varied in height but had average dimensions of 20 ft. high, 40 ft. wide, and 400 to 850 ft. long. The tunnels are at an elevation of 700 ft. and have a protective cover of 230 ft.

Eight vertical ventilation shafts were planned. An elaborate ventilation system was designed to keep the temperature down, because gypsum stone does not withstand high temperatures. In the tunnels the temperature was normally 50 to 55 deg. F. Each suction blower of the ventilation system had a capacity of 7,000,000 cfh., giving 40 air changes per hour in the hydroforming chambers and 10 to 20 changes in other parts of the plant.

At the end of the war about 60 percent of the excavation for this refinery was complete. The difficulty of erecting large vessels in chambers with limited headroom was never satisfactorily solved.

Jap Makeshifts

Before the war's end the Japanese were going underground as rapidly as possible. Their installations were almost entirely fabrication or assembly plants. Construction and design was crude and no attempts were made to make the plants livable nor to protect the machinery from corrosion by the damp atmosphere. There is little in the Jap experience which can be utilized in designing an adequate underground factory.

Perhaps the most interesting and most advanced Japanese plant is Yoshimatau, operated by the Nakajima to produce airplane engines. Located in Matsuyama, near Tokyo, it was in production from June 1945 until the end of the war. The plant is located in caverns dug by cave dwellers about 1,500 years ago. There are more than 100 caves, each with an entrance 4 to 5 sq. ft. in size and opening into a hemispherical room 8 to 10 ft. in diameter. The planned design called for 353,000 sq. ft. of floor space. More than 300 machine tools were in operation at the end of the war. Unusual features of the plant included nine heat treatment tanks dug into tunnel floors, tall machines sunk into the floor, and 750-kva. transformer banks underground for each of the five completed areas. Although the desiccating quality of the volcanic rock kept the tunnels fairly dry, corrosion of machinery began immediately and was a constant problem.

Unhurried Swedes

Although not a belligerent in World War II, Sweden was close enough to hostilities to take precautionary measures. Among them was the movement of much of the Swedish aircraft industry underground. But since Sweden was not at war it had time to plan its underground plants, and they are complete, efficient factories. Although not designed for chemical manufacture, some of the lessons learned in their design can be applied to any type of underground endeavor.

Carved out of solid rock, the tunnels in which the plants are situated are cut in the form of a Tudor arch. Inside this archway sheathing and wooden flooring conceal the rock walls from the workmen. The entire plant is air conditioned, and the space between the roof of the rooms and the rock roof is used as the ventilating return line. By keeping the air slightly drier than usual all water dripping is avoided and no grease is needed to prevent machines from rusting. The temperature conditions are such that cooling is usually needed year round. Light colored walls and ceilings give an air of roominess.

Construction costs for underground plants vary widely with the quality of rock encountered. Faults and cracks add expense just as they do in the foundations of ordinary plants. In general, Swedish factories built underground have cost about 15 percent more than similar surface plants. Sizable economies are achieved, however, in maintenance and heating, and building costs are minimized. It has been stated that the over-all costs over a 30 year period may be 10 percent lower for an underground plant than for one built above ground.

Future Work

Lessons learned from the experience of World War II indicate that there are real problems in designing underground plants. The haphazard construction of the Japanese could not be tolerated even in wartime. The Germans have illustrated graphically some of the problems of installing tall equipment. The Swedes have shown, on the other hand, that an attractive assembly line plant can be built underground. They have apparently solved the problems of corrosion and satisfactory working conditions. It is evident that year-round air conditioning is necessary. The bare rock walls should be out of the workers' view.

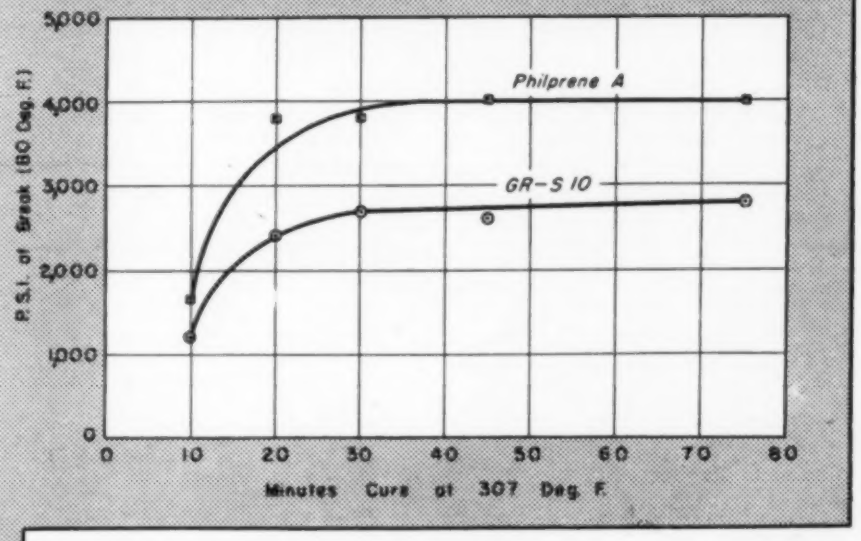
The possibility of atomic bombing presents problems that even the Swedish did not face. Plant workers have to be protected from radioactive particles and poisonous fumes as well as from the direct concussion. By lead baffling of zig-zag ventilation tunnels and the use of air-tight lead doors, Sweden believes this problem is solved. The bigger problem is to decide how much earth cover is necessary to withstand the shock of a nearby atomic explosion.

The Corps of Engineers plans scale tests on the effect of blast on underground plants next summer. Several studies have been made by engineers and others on the availability of abandoned mines in the West and Midwest. A consulting firm in New York is readying a report for the War Department on the lessons to be drawn from German experience. Other methods of passive defense are being studied.

The real conclusion of the investigations of underground plants is that they can be built. Design problems are severe and costs will perhaps be high. Because of this it appears doubtful that companies will build underground on their own initiative. The War Department will have to supply the necessary incentive.

TYPICAL COMPOSITIONS

	Parts	
	Philprene A	Philprene B
Elastomer	100	100
Philblack O	45	50
Zinc Oxide	3	3
Stearic Acid	2	—
Agerite	1.2	—
Sulphur	1.75	1.75
Santocure	0.95	0.80
Circo Oil	2.75	—
Pareflux	2.26	—
Asphalt No. 6	—	10



Stress-strain relationships indicate improvement in properties gained by polymerization at low temperatures. Philprene A is polymerized at 41 deg. F.

Low-Temperature Rubber

New synthetic rubbers with marked improvement in properties have recently been announced. The improvement comes from polymerization at low temperatures, as low as 0 deg. F. To acquaint engineers with the properties of these new rubbers, this article was written by W. A. Schulze, W. B. Reynolds, C. F. Fryling, L. R. Sperberg, and J. E. Troyan of the Phillips Petroleum Co. The elastomers, made by Phillips, are in production in pilot plant quantities.

PERFORMANCE of low-temperature chemical rubber in numerous recent road tests has stimulated interest in elastomers prepared in refrigerated emulsion systems. Recently, Phillips Petroleum Co. announced that two types of low-temperature rubber are in production on pilot plant scale at Phillips, Tex.

At the start of the synthetic rubber program, the effect of many process variables in emulsion polymerization was not known. In particular, the effect of temperature of polymerization on polymer properties was unknown. The official "Mutual" recipe called for a reaction temperature of 122 deg. F., primarily because this temperature gave a sufficiently high reaction rate to make the process economically feasible.

During 1943-45, there were indications that lower temperatures during polymerization would give better synthetic rubber. Catalysts then available were not active enough to give a commercial reaction rate at low temperatures. To investigate the possibilities of lower temperatures, Phillips installed a pilot plant in 1944 which could polymerize as low as 0 deg. F. Two approaches were tried: Ferrocyanide-activated diazo thio ether and iron-activated "redox" catalyst systems. Work on the former system was initiated under the Office of Rubber Reserve at the University of Cincinnati and the University of Minnesota. Redox systems were described in patents assigned to the B. F. Goodrich Co. Apparently independently, the Germans also developed redox recipes. Work at the University of Minnesota introduced the use of organic hydroperoxides as oxidant in redox systems.

Private research by Phillips has led to exceedingly rapid catalyst systems suitable for commercial polymerization of synthetic rubber at subatmospheric temperatures. Pilot plant production began well over a year ago.

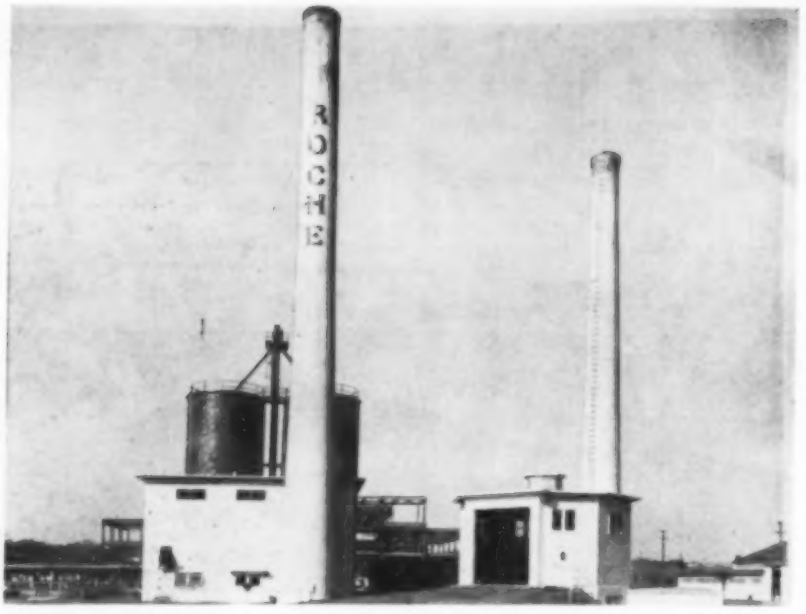
Philprene A is the trade-marked name applied to Phillips rubber produced at 41 deg. F.; Philprene B that polymerized at 14 deg. F. Both are butadiene-styrene copolymers containing about 24 percent bound styrene. Both are normally compounded with additives before use. Two of the typical formulations are shown below.

Vulcanizates of Philprene A are characterized by high tensile strength, resilience, and flex life; abrasion resistance is good and processing characteristics excellent. Use of high-abrasion furnace black gives the best properties with Philprene A. Excellent processing characteristics permit low-softener levels for maximum tire tread wear while maintaining good cracking and cut-growth properties. Normally, an improvement in tread wear is accomplished only at the expense of poor cracking and cut-growth characteristics. Superior hysteresis-flex life of Philprene A allows the retention of the latter properties when treadwear is improved by low-softener levels.

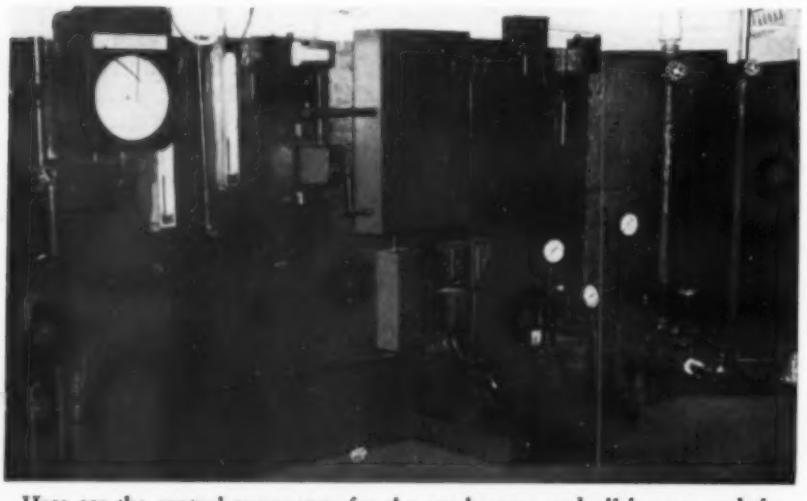
Road tests of Philprene A tires have shown 20 to 40 percent greater tread wear than GR-S 10 tires and are superior to first-line natural rubber treads.

Philprene B is a later development and has not been as extensively tested. In general its properties are superior to those of Philprene A. The excellent physical properties indicate that it will be of outstanding value in tire treads. At low carbon black loadings its potential use in tire carcass stocks is suggested.

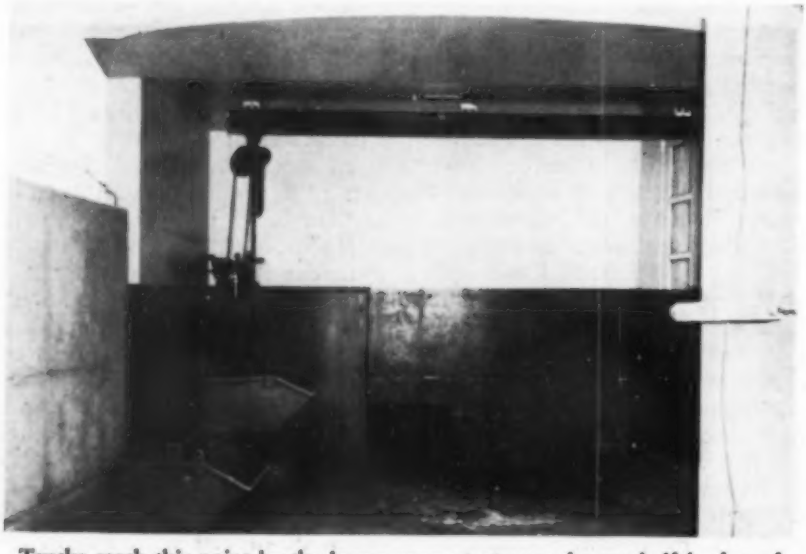
The properties of these new low-temperature rubbers suggest many applications in the latex, wire and cable, and mechanical goods industries.



Situated to the right of the power plant, the new incinerator building is approached by ramps to both its upper and lower levels



Here are the control pyrometers for the gas burners and oil burner, and the positive displacement pump for stink liquor



Trucks reach this point by the lower ramp to remove the one-half bucket of ash produced daily to the plant dump

Incineratio S

EDITORIAL STAFF

CLOSE and effective cooperation with public sanitation authorities, coupled with ingenious engineering initiative, was the recipe employed by Hoffman-La Roche, Inc., in solving a serious waste disposal problem. Three years of trial of the disposal method finally chosen has resulted in the completely successful abatement of the nuisance, without complaint from either townspeople or public authorities. The story of the five steps leading to the final solution should be of interest to other engineers with comparable waste disposal difficulties.

Sharp wartime expansion of the output of this Nutley, N. J., manufacturer of synthetic vitamins, pharmaceuticals and fine chemical specialties, was the immediate cause of the trouble. One process produced an alkaline mother liquor containing organic polysulphides which can best be described by its plant name of "stink liquor." Initially amounting to less than 500 gal. per day, the expansion program increased the quantity of this waste to about 1,200 gal. per day and brought with it the impossibility of further disposal of the liquor in the public sewers.

At this point, it became evident that the plant sewer connection for process and sanitary sewage was of insufficient size and its change from 10 to 24 in. was expected to resolve the difficulty. This was not the case, nor did a thorough liming produce a sewage which could be relied on to be free from complaints. Eventually, the Passaic Valley Sewerage Commissioners, in whose jurisdiction the public sewer fell, ordered the company to find a new disposal method for the stink liquor.

The next expedient was to cart the liquor in drums or a tank truck, to be buried at a private dump. Within five months, dumping privileges were withdrawn successively at six different dumps, and a chemical solution was then sought. Study showed that overchlorination would reduce the sulphur compounds to an inoffensive state, suitable for the sewers, and this course was followed for a time with the consent and active assistance of the sanitary authorities. However, chlorine was scarce and the process required $70 worth for each 500 gal., while failure to reach the end point per-

Solves a Waste Disposal Problem

Not every waste disposal problem has a happy ending. This plant's "stink liquor" was ruled out of the public sewers and chased out of the private dumps. The company found that the liquor could be destroyed inoffensively in an incinerator, along with the plant trash. If its disposal cannot be said to earn a cash return, at least it is earning dividends of public good will for a chemical plant situated in what is largely a residential rather than a manufacturing community.

The furnace charging door on the upper level is provided with a guard rail

mitted reversion of the odorous material and necessitated painstaking and time consuming tests of every batch. It was finally decided to try a totally different approach in which neither public sewers nor private dumps would be involved.

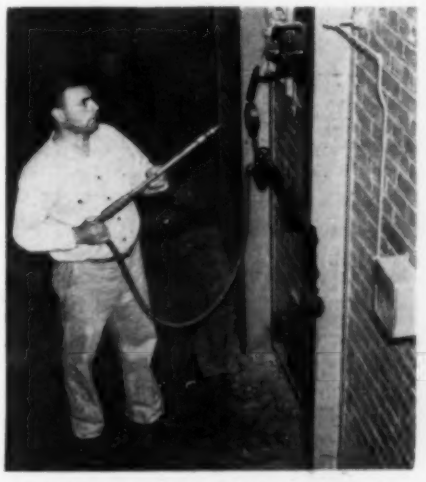
Stink Liquor Incineration

Pilot plant work showed that the stink liquor could be evaporated and incinerated in the presence of about 70 percent excess oxygen at temperatures above 850 deg. F. This produced an inoffensive mixture of SO_2 and CO_2 which was easily dissipated from a stack of medium height. It was decided to combine destruction of the stink liquor with incineration of a part of the plant's trash and cafeteria waste, and for this purpose Nichols Engineering Co., of New York, was called in to build a modified version of its Hiler garbage incinerator.

The incinerator building is laid out for convenient access by ramps to both the upper, or charging, floor and the lower, or furnace floor. Two special features of the furnace adapt it to the requirements of this installation. Its crown has been weakened intentionally to serve as an "explosion hatch" in case explosive materials should accidentally be introduced with the trash. An enlarged combustion chamber between the bridge wall and the stack breeching has been provided into which stink liquor is sprayed for evaporation and combustion.

Since much of the waste to be consumed contains too large a quantity of moisture to support its own combustion, additional heat is provided by burning either 530 B.t.u. city gas, or No. 2 fuel oil, or both. The gas is supplied to two burners by a pressure booster, while a steam atomizing Hauck burner is used for the oil. Temperatures near 900 deg. F. are closely maintained regardless of the rate at which trash is charged, by an automatic control system in which oil carries the base load, while the two gas burners cut in separately on a 50 deg. temperature differential.

The incinerator is not run around the clock, but is regularly shut down for the night and reheated in the morning. When a high enough temperature has been reached in the morning, the stink liquor is pumped from underground storage tanks to special nickel spray heads producing a solid cone spray, which are inserted into opposite sides of the combustion chamber. Incineration of the liquor requires about 4 to 6 hours per day and leaves only a few shovelsful of solid deposit for removal from the access doors. No destruction of the firebrick refractories is experienced so long as a satisfactory spray is produced.



Stink liquor is injected into the combustion chamber through nickel sprays

Trash Charging

Trash is charged manually through a feed door in the floor above the furnace. Trucks readily reach this floor by means of the upper ramp, dumping directly on to the floor for further manual handling. Ash and metal are removed periodically from the bottom of the incinerator, to buckets handled by a chain hoist and trolley. About one-half bucket of ash is produced per day and is later removed to the plant dump by a truck which gains the furnace level by the lower ramp.

For permission to inspect this plant, we are indebted to Dr. A. J. Frey, head of production and development, under whose direction the work was carried out, and to Arthur Wright, consulting engineer, and W. W. Squire, of the company's engineering department, who were immediately responsible for the development of the method finally chosen.

On the lower level, this cart serves to remove ash from the incinerator

Activated Carbon

manufacture
capacity of adsorption
use in solvent recovery

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USEFULNESS OF ACTIVATED CARBON IN SOLVENT RECOVERY DEPENDS ON PRODUCTION METHODS AS WELL AS INHERENT CHARACTERISTICS

RECOVERY of solvents by means of activated carbons originated during World War I and the first major installation was made in Germany. This process of recovery is based upon the adsorbent qualities of activated carbon, which in many respects are very similar to those of other industrial adsorbents like fuller's earth, activated clays, silica gel, and activated alumina and magnesia. It is not intended here to go into detailed discussion of the complex theory of adsorption, but it will be useful to say a few words about activated carbon itself. It is a form of pure carbon which has a very great porosity. Such quality exists in a natural state in certain species of carbon but it is generally developed by physical and chemical processing of a carbonaceous material. The purpose of the activation process is to increase the number or size of the pores in the material. To give a better idea of the carbon's porosity, one pound presents a surface of 3½ to 5 million sq.ft.

The importance of the activated carbon industry can be noted from the American production for 1944, which was 2,250 tons monthly, excluding types used for war purposes. During the same period, German production was reported to be 660 tons monthly, of which 175 tons were industrial carbons and the balance mainly army type for poison gas protection.

manufacture ..... *Two Steps*

FROM the discussion to follow it will be understood that by varying the raw materials and the process of manufacture it is possible to obtain different kinds of activated carbons, either in granular, powder or pellet form, according to its intended use. For example, at the present moment Carbonisation et Charbons Actifs, abbreviated C.E.C.A. manufactures thirty-two different kinds, all of which are marketed under the tradename, "Acticarbone."

(1) CARBONIZATION. The first step in the manufacture of these adsorbents is the carbonization of a suitable organic material. Such carbonization can be the consequence of a natural phenomenon, hence the formation of peat, soft coal, or anthracite, depending upon the degree of carbonization. The further treatment of such products by activation has not given good results except in the case of peat and certain bituminous coals. A great amount of research was performed in Germany in this field during World War II, but as far as we know from Technical Intelligence Reports they were not successful. However, on various occasions good results have been reported from different countries on the activation of coal in order to obtain high-grade activated carbon, and during recent years the production of activated carbon from coal has rapidly increased in the United States. Apart from peat and certain bituminous coals, the best products are obtained by the carbonization of certain woody substances such as cocoanut shells, beech wood or even pine wood.

(2) ACTIVATION. Activation by steam at temperatures of 900 to 1,000 deg. C. is the process which was first used and it is still in use. But lately great advancements have been made in activation by means of chemicals, among which the more widely used are zinc chloride and potassium thiocyanide.

A general procedure for the manufacture of activated carbon by combining physical and chemical processing after carbonization would be as follows: The charcoal which has been pulverized after carbonization is charged to a mixer together with activating solution. A typical formulation would be that prepared by adding 700 lb. of potassium carbonate to 78 gal. of 7 percent solution of potassium thiocyanide. The solution would be used in the ratio of 100 lb. of charcoal to 17.5 gal. of solution. The mixer is heated to about 120 deg. C. and after three hours the contents are transferred to a pulverizer. The ground material is then mixed with wood tar

and water. Normal proportions would be charcoal, 100 lb.; beech wood tar, 25 lb.; and water, 1.5 gal. The resulting paste is then extruded into rods of about ⅛ in. diameter; which in turn are cut into lengths of ⅛ in. The pellets obtained are dried in a rotary dryer before being activated in kilns which are maintained at a temperature of 900 to 1,000 deg. C. The finished product has the appearance of small hard black pellets of cylindrical shape.

capacity of adsorption ..... *Five Variables*

HAVING obtained an informal conception of how activated carbon is manufactured, it is desirable to review the characteristics of activated carbon when functioning as an adsorbent for organic solvents.

If a current of air laden with solvent vapors is passed through a bed of activated carbon, the vapors are retained in liquid form first on the surface of the pellets themselves and then inside the numerous capillary tubes within the porous material. In this case the bed acts like a filter. At the beginning all the vapors are retained by the carbon, but after a certain time traces of solvent begin to appear in the exit air. This is called the breakpoint of the carbon. If the flow of air is continued after the breakpoint, an additional amount of solvent is adsorbed until the activated carbon becomes saturated. The amount of solvent which can be retained at the saturation point varies with the conditions of use, but in extreme cases can equal more than 80 percent of the weight of the adsorbent itself. However, for ordinary solvents, the weight retained is generally around 40 percent; that is to say, 100 lb. of bone dry carbon will retain 40 lb. of benzene. Following are the five variables which determine this quality, capacity of adsorption.

(1) TYPE OF VAPOR. Each solvent has an inherent intensity of adsorption over which we have no control other than the production of a special carbon with high specific adsorption for this particular solvent. (Note, for example, in the second table below the difference in the ability of three different carbons to retain benzene.) The effect of the individual intensity of adsorption of different solvents is illustrated by the following data.

Different Adsorptive Capacities for Different Solvents

Solvent	Concentration Lb. per 1,000 Cu Ft.	Wt. Adsorbed, Lb. per 100 Lb. Carbon (68 Deg. F.)	Intensity of Adsorption
Chloropicrin	0.93	82.3	Very strong
Heptane	1.11	39.2	Very strong
Pyridine	0.34	48.5	Very strong
Trichlorethylene	2.35	77.5	Strong
Ethyl acetate	1.8	48.5	Strong
Carbon tetrachloride	4.7	78.0	Medium
Benzene	1.8	41.7	Medium
Ethyl ether	22.2	37.2	Medium
Ethyl alcohol	0.55	31.5	Medium
Acetone	3.1	37.3	Low
Carbon disulphide	11.0	64.0	Low
Water	0.086	1.5	Very Low

Note: Air concentrations (first col.) are equivalent to 10 percent of saturation at 68 deg. F.

(2) CONCENTRATION. The figure which is generally taken as the concentration suitable for industrial purposes is 0.4 to 1 lb. of solvent per 1,000 cu.ft. of air to be treated. However, in some cases it is possible to treat air containing as low as 0.1 lb. of solvent per 1,000 cu.ft. The capacity and efficiency of adsorption for this very low concentration are usually satisfactory and only the great volume of air to be handled, which increases the cost of the industrial plant, is the limiting factor. The effect of concentration upon capacity of adsorption for three different carbons can be illustrated by the data below, using benzene as the example.

Different Adsorptive Capacities for Different Concentrations

Degree of Air Saturation, Percent	Weight of Benzene Adsorbed (68 Deg. F) Carbon A	Carbon B	Carbon C.
90.0	54.9	48.8	63.0
10.0	47.6	39.0	44.5
1.0	39.9	22.2	22.0
0.1	30.7	11.2	11.3

(3) TEMPERATURE. This variable has a large influence upon the capacity of adsorption, which decreases very rapidly as temperature increases. Therefore hot gases must be cooled to 80-95 deg. F. before being treated by activated carbon for solvent recovery. The effect of temperature upon adsorption capacity is obvious in view of the ease of regeneration by means of heat.

(4) NUMBER OF VAPORS. If Vapor A presents toward activated carbon an intensity of adsorption greater than Vapor B, Vapor A will always displace B from the carbon. At the beginning all vapors are retained until the limit of adsorption is reached. At this moment the vapor having the greater intensity of adsorption displaces the others previously adsorbed. In effect a fractionation takes place within the adsorbent bed. This property is the basis of the selective adsorption process employed for the separation of gases and known in this country as the hypersorption process.

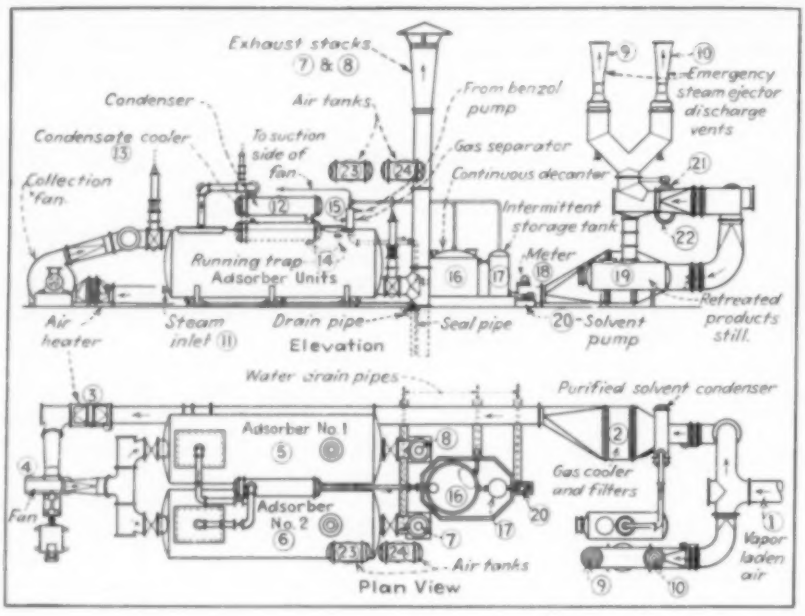
(5) CONTACT TIME. This factor is very important in the design of any recovery plant as it gives the minimum volume of activated carbon which is to be used to treat a given flow of gases. For design purposes a contact time of 1 to 4 seconds is employed.

use in solvent recovery ..... *Seven Phases*

ON THE above information it is now easy to visualize how a solvent recovery plant utilizing activated carbon functions. The collected stream of solvent laden air is passed through a vessel containing a bed of activated carbon. When the carbon is loaded to the breakpoint, the stream is switched to a duplicate unit while the first one is regenerated by means of steam prior to being returned to service. Following are the important aspects of a solvent recovery plant.

(1) COLLECTING SYSTEM. Solvent vapors are collected from the machines or process rooms where evaporation takes place. This collection requires the design of complete ventilation systems which often either partially or totally inclose the machines. Very often, in order to obtain a better concentration of solvent vapors, semi-closed circuits must be provided. The ventilation piping is connected to a central motor driven fan which maintains a suitable negative pressure. It is easily understood that such arrangement not only realizes the collection of solvent vapors but also provides the ventilation of the process rooms, thus creating better working conditions. This second point has its importance when we consider that many solvents are obnoxious or toxic, even at very low concentrations. This is the case of benzol, which is commonly used as a solvent in the rubber industry.

(2) AIR COOLER. The solvent laden air must be cooled and depurated before being passed through the bed of carbon. It must be cooled to obtain a better efficiency of adsorp-



How it Works. This is a typical design for large solvent recovery systems using activated carbon. The sequence of operations: Air from the vapor duct (1) is drawn through the gas cooler and filters (2) and through the air heater (3) by the collection fan (4), which discharges it alternately to the adsorbers (5) and (6). The stripped air is alternately discharged to the atmosphere through exhaust stacks (7) and (8). Two emergency steam ejectors (9) and (10) go on automatically if the negative pressure in the vapor duct is not maintained by the collection fan. During regeneration, steam is admitted through steam inlet (11). The mixture of steam and solvent vapors passes to the condenser (12) and then to the condensate cooler (13). A running trap (14) maintains the desired liquid level in the condensate cooler. Noncondensable gases are removed in the gas separator (15) and returned through a common vent line to the suction side of the collection fan. Cooled condensate is separated in the continuous decanter (16). Recovered solvent is pumped from intermittent storage (17) through meter (18) to retreated products still (19) by solvent pump (20). The purified solvent, freed from higher boiling constituents, such as plasticizers, is condensed by purified solvent condenser (21), and cooled by purified solvent cooler (22). Often purification of the solvents is not necessary and the solvent is pumped directly from the intermittent storage to recycle storage (not shown). The valves are air actuated, cylinder operated. Two auxiliary air tanks (23) and (24) are provided for emergency use.

tion and depurated to eliminate the possibility of poisoning the adsorbent or corroding the installation. This cleaning is generally effected by use of oil type air filter cells, by washing the air stream with an appropriate scrubbing unit, or by means of electrostatic precipitation. If cooling of the air is effected by means of a circulating water spray, it is desirable to install an air heater to raise the temperature of the air 3 or 4 deg. F. prior to passing the vapors through the bed of activated carbon.

(3) ADSORBERS. After depuration the air stream is passed through the adsorber containing a bed of activated carbon, which retains the solvent. The stripped air is discharged to atmosphere.

Although the air collecting systems of hoods and ducts differ throughout the various industries because of the widely divergent manufacturing conditions encountered, the design of the recovery system has become more standardized. Vertical adsorbers are employed for small and medium sized plants. Where large volumns of air must be handled, horizontal adsorbers are preferred. The layout and operating cycle of a larger solvent recovery plant are shown in the drawing appearing above.

(4) REGENERATION APPARATUS. Live steam is admitted into the adsorber, generally countercurrent to the flow of air, to strip the solvent from the carbon. The mixture of steam and solvent vapors passes to a condenser and cooler. In the case of solvents immiscible with water, the cooled liquid is separated by continuous decantation. In the case of a solvent miscible with water, it is necessary to provide a fractionating column. The steaming of solvent vapors out of a carbon bed is not complete as this would involve too great a consumption of steam. A residual amount remains and the difference between the amount adsorbed at the breakpoint and the normal residual solvent after regeneration is defined as the practical coefficient of utilization of the adsorbent. Such a figure varies from 8 to 20 percent by weight according to the type of solvent and the other variables previously mentioned. This figure is always lower for solvents miscible with water.

After steaming, the carbon is cooled and dried by circulation of a current of air. This air is very often provided by taking a percentage of the collected air and passing it through the adsorbent during a short period. After this, the vessel is ready for normal operation to be resumed.

(5) CONTROLS. For automatic operation a cycle controller with its necessary auxiliary compressed air system is required to operate the valves that control the flow of air and steam during adsorption and regeneration. In addition, it is desirable to have automatic control on the flow of water to the air cooler, to the condenser and to the solvent cooler. Adequate safety controls must also be incorporated in the design.

By tracing the flow of air and steam in the drawing the inter-relationship of the elements discussed above will be more clearly understood.

(6) ECONOMICS. The over-all efficiency of a solvent recovery plant depends on two factors: the efficiency of the vapor collecting system and the efficiency of the adsorbers themselves. The first depends mainly on the proper design of the exhaust system and efficiencies as high as 90 percent can be realized in the case of spreading or calendar machines. The efficiency of a carbon bed is very high indeed, above 95 percent. In many cases it is possible to guarantee as high as 99 percent of the solvent passed through the recovery plant.

Except for the value of the solvent recovered, the direct operating costs are the most important factors that determine whether solvent recovery by activated carbon is economically feasible. There direct operating costs are labor, steam, electricity and water. Labor costs are reduced to a very low figure as most of the installations are automatically controlled. Steam consumption varies from 3 to 5 lb. per lb. of solvent recovered; power from 0.05 to 0.15 kwh. per lb.; and water from 5 to 10 gal. per lb. The figures actually obtained on a C.E.C.A. recovery plant in Chicago are as follows: Efficiency of recovery, 97.4 percent; steam consumption, 3.7 lb. per lb.; power consumption, 0.0505 kwh. per lb. of solvent

recovered; and water consumption, less than 7 gal. per lb.

The following performance guarantee was made by C.E.C.A. on a recent installation in England: Efficiency of recovery, 95 percent; actual recovery, 213 U. S. gal. of benzene per hr.; steam, 3.5 lb. per lb. of benzene recovered; electricity, 0.06 kwh. per lb.; and water, 7 gal per lb.

(7) **APPLICATIONS.** Activated carbon solvent recovery systems are widely used by these industries:

Rubber industry, for the recovery of benzol, carbon disulphide, trichlorethylene and ethylene dichloride.

Synthetic Fiber Industry and the Allied Transparent Film Industry, for the recovery of ketones and benzene.

Degreasing Plants, for the recovery of benzene, carbon tetrachloride, trichlorethylene and solvent naphtha.

Fermentation Plants, for the recovery of alcohols and acetone.

Printing Industry, for the recovery of xylene, toluene and acetates.

Paper and Fabric Coating Industry, for the recovery of alcohol, acetates, ketones and other varnish and lacquer solvents.

Gas Industry, for the recovery of benzol and hydrocarbons.

This gives a partial picture of the broad field open to the use of activated carbon in solvent recovery. Actually, the potentialities are limited only by the ingenuity of the engineer in selecting proper materials of construction, instruments of control, and a proper type of activated carbon suitable for each particular solvent recovery problem.

HIGH INTENSITY SOUND

(*Continued from page 101*)

and bag filters. First installation was in the Godfrey L. Cabot plant at Pampa, Tex., on a small unit making furnace black from natural gas. Here, about 2,000 cu. ft. per min. is passed through the acoustic chamber where fine particles are agglomerated at a frequency of 3.5 kc. per sec. and an intensity of 160 decibels. About 96 percent of the carbon black is recovered.

How It Works

Action of the sound waves is to agitate the particles of the aerosol to such an extent that they collide and adhere in groups or agglomerates of such size and weight that they may be readily collected by cyclone separators. The rate at which the particles change in size is a function of frequency of collision and of particle stability following collision. It is the difference in velocity between particles that makes them collide more frequently. Extremely small particles tend to follow the vibrations of sound while larger particles having greater inertia move more slowly or tend to float. By increasing the difference between velocities of different sized particles, sound waves cause more frequent collisions thus effecting particle agglomeration.

Based on experimental work it has been found that sound may be used to build up agglomerates of most solid, dry aerosol particles until they have a settling rate of ½ cm. per sec. or more with diameter of 15 to 100 microns or larger. As the agglomerate increases in size, the number of contact points holding it together in any one plane increases as the square of its effective diameter while its mass increases as the cube of its diameter. Thus, a condition may be reached where the agglomerate becomes unstable so there appears to be a limit on the size to which an agglomerate can grow. Experimental work has substantiated the fact that after exposure to high intensity sound vibrations, the average size of agglomerates will reach a maximum with practically all of the particles in the form of aggregates having settling rates of ½ cm. per sec. or greater. Particles with a ½ cm. per sec. settling rate can be readily separated from an air stream by cyclone separators.

Where aerosol particles are not dry or are composed of naturally adhesive materials, the ultimate size of agglomerates may be larger than that indicated above. Liquid particles, too, may be agglomerated to larger sizes.

Generally, sound wave agglomeration finds application where particle diameters are below 10-15 microns and where the concentration is not lower than 2 grains per cu. ft.

While Ultrasonic's standard sound generator can produce vibrations as high as 200 kc. per sec., the frequency is selected that will cause the greatest difference in particle velocities so that particle collision and agglomeration will occur.

Without high intensity, however, agglomeration won't occur because it takes considerable energy to increase particle velocity. So far, 160 decibels or higher have been found necessary to successfully agglomerate most aerosols.

While much of the underlying theory relating to aerosol agglomeration by means of high intensity sound is still being studied, the effectiveness of the method appears established by pilot plant and laboratory tests.

Variety of Uses

In addition to the carbon black installation, a number of other similar applications are either under way or being studied. Included in these are the following: First is soda recovery from the stack gases of a large Maine paper mill. A sound unit is now being placed in operation to treat 70,000 cu. ft. per min. of flue gas from black liquor smelters. A similar installation will be for salt cake and soda recovery from the stack gases of a kraft pulp mill in the Pacific Northwest. This installation will be made in a few months. It will be designed to handle 40,000 cu. ft. per min. of flue gas.

Heavy chemicals too are finding applications. A manufacturer of sulphuric acid in New Jersey is investigating the use of sound waves for precipitating sulphuric acid mist. Here the agglomerating tank and other exposed equipment will require lead linings and coatings. While cyclone separators are used for dust cellection, the sulphuric acid droplets will be collected by a specially designed baffle arrangement.

The steam power field is also being investigated and a sound unit will soon be installed in a large New England utility plant for recovery of dust from flue gas.

Dispersion of natural fog is an old problem but preliminary tests indicate the possibility that Ultrasonic units might be successful. A program of development is being carried out under a Navy contract. If this is successful, its main application will be to clear fog from airfield runways.

So far, most of the push has been on dust and mist collection but a program of research and development is under way in other fields. An experimental unit will be installed on a paper machine in the Southern Advance Bag and Paper Co. plant at Hodge, La. It may well aid sheet formation at the headbox slice. By vibrating the slush pulp at this point, more rapid drainage of water is expected and the felting and formation of the sheet may be modified.

The soap industry too, is trying sound in certain processes. One big manufacturer is using sound to aid the spray drying of powdered soap. In this pilot plant the sound vibrations are directed toward the atomized soap globules at the top of the spray tower. When the particles are vibrated, their surface is exposed to more drying air and consequently they dry faster.

Clarification Needed for Distillation Terms

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CLEARCUT DEFINITIONS OF THEORETICAL PLATE, CONTACT UNIT AND THE CORRESPONDING EFFICIENCIES AVOID DIFFICULTIES IN COMPUTATIONS

Although the concepts of theoretical plate and plate efficiencies are well known, it is desirable to review their precise meanings and prevent confusion. The author advocates distinguishing between the theoretical contact unit, which gives one perfect contact, and the theoretical plate, which may perform more than one perfect contact. Similarly, he proposes differentiation between contact efficiency and plate efficiency.

CALCULATING the number of plates required for a specified separation of miscible volatile liquids by distillation is based on the theoretical plate. This is also called the perfect or equilibrium plate. The commonly accepted concept of a theoretical plate is a vapor-liquid contact device which achieves equilibrium under distilling column conditions. That is, a theoretical plate is one that attains equilibrium between the vapor rising from the plate (and passing to the plate above), and the liquid leaving the plate (and passing to the plate below). See references (1), (2), and (3).

After determining the number of theoretical plates of the distillation column, one obtains the number of actual commercial plates by dividing the former by the plate over-all efficiency. The methods of such calculations are well established and their mathematical basis accepted. It is, however, the writer's opinion that the concepts of theoretical plate and plate efficiency need to be reviewed, so as to be clarified and made more definite. This paper will attempt to do so. The effort will be justified if it presents a clear and precise concept of the theoretical plate and of plate efficiency. It is also hoped that it will be helpful in eliminating possible confusion concerning commercial plate efficiencies greater than 100 percent—that is, greater than the efficiency of the theoretical or perfect plate.

Contact Unit vs. Plate

Functionally, a plate is simultaneously a diffuser and a heat exchanger. Treating it as a heat exchanger and making an enthalpy balance, the enrichment from plate to plate of a column consisting of theoretical plates can be calculated—as in the method originally proposed by Sorel, or in the graphical method of Ponchon-Savarit. Or, treating it as a diffuser and making a material balance—assuming constant molal overflow and vaporization in the section (enriching or stripping)—the enrichment from plate to plate of a column consisting of theoretical plates can be calculated. The graphical method of McCabe-Thiele, used for the latter purpose, is in more widespread use because of its inherent simplicity and because it serves more readily as an analytical tool in distillation. It is for the same reasons that the McCabe-Thiele method will be used in developing the discussion to follow.

With the assumption of constant molal overflow and vaporization, the over-all material balance per unit time for the enriching section is

$$V = L + D \qquad (1)$$

and the material balance on the more volatile component between any two adjacent plates is

$$Vy_{n+1} = Lx_n + Dx_0 \qquad (2)$$

or

$$y_{n+1} = \frac{Lx_n}{V} + \frac{Dx_0}{V} \qquad (3)$$

where D = overhead product, mols; L = overflow from plate to plate, mols; V = vaporization from plate to plate, mols; x = composition of the liquid phase in terms of the more volatile component, mol fraction; and y = composition of the vapor phase in terms of the more volatile component, mol fraction. The subscripts refer to the respective plates, with subscript 0 referring to the condenser.

Vapor Composition Value

Since the vapor composition varies in the direction of the liquid flow on the plate, to be able to write Equation (2) the average value of the vapor composition must be used.

Equation (3) represents a straight line with a slope equal to L/V. In a physical sense it is the equation of the operating line, which means that the compositions of the vapor and liquid streams passing each other between any two adjacent plates will be represented by a point (x_n, y_{n+1}) on the line. It will be observed that Equation (3) contains two unknowns and in order to be able to solve it and use it in dis-

tillation calculations, a second function is required. Obviously the second function is the x–y equilibrium curve. However, in order to be able to solve Equation (3) simultaneously with the x–y equilibrium curve, the concept of the equilibrium plate is introduced. The definition of such a plate was given above, although as stated before it needs further clarification.

Plate Definition

A plate is a unit in itself, having the function of performing a certain degree of separation of a mixture. Accordingly, as the liquid travels across the plate from point of entrance to point of overflow to the plate below, it undergoes certain changes in composition—in a stepwise manner if the plate is of the bubble cap type, and in a continuous manner if the plate is of the screen type. For instance, considering the *n*th plate, the liquid overflowing from the plate above enters it at a composition of x_{n-1} and overflows to the plate below leaving the plate at a composition of x_n; the vapor entering the plate is of composition y_{n+1} and when leaving it it is at a composition of y_n. Here both y_{n+1} and y_n are as pointed out, average values. An equation for the operating line for an individual plate, such as the *n*th plate, may be written by making a material balance between the terminals in terms of the more volatile component, namely

$$V(y_n - y_{n+1}) = L(x_{n-1} - x_n) \qquad (4)$$

which represents a straight line with a slope equal to L/V.

It is evident that the operating lines for the enriching section and for the individual plates in the enriching section coincide with each other, whether the plates are considered theoretical or actual. A similar statement may be made in regard to the stripping section of the column. Considering for the moment only bubble cap type plates, if it is assumed that the bubble cap acts as a perfect contactor—meaning thereby that within the sphere of action of the bubble cap the liquid is of uniform composition and is also in equilibrium with the vapor passing through the bubble cap and bubbling through—then each graphical step in the McCabe-Thiele method (considered as corresponding to one perfect plate) becomes equivalent to one perfect contact unit. Therefore, if the theoretical or perfect plate is to be taken as the basis for fractionating column calculations, it should be defined as a plate which provides to the liquid an opportunity for only one perfect contact.

This means that the theoretical plate may either be one which contains a single bubble cap, or one with a number of bubble caps arranged in a row across the path of the liquid. In the latter case the concentration gradient will be the same across each bubble cap. However, a plate consisting of two or more perfect contacts will still be a perfect plate. Hence, to avoid any confusion the terminology should be clarified. As far as plate column calculations are concerned, it will be preferable that the theoretical contact unit—instead of the term theoretical plate—be employed. In other words, in the McCabe-Thiele method (and in any other method, for that matter), it will be the number of theoretical contact units which will be determined.

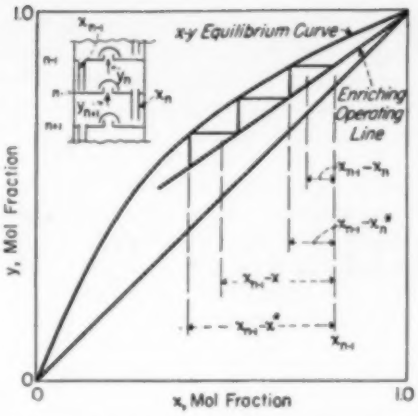

Fig. 1—Graphical definition of quantities involved in contact and plate efficiency and relative plate efficiency

Plate Efficiency

Plate efficiency may be defined as the ratio of the actual performance of the plate to the performance that would be obtained if it were a theoretical plate. For any one contact unit, the contact efficiency would be

$$E_c = (x_{n-1} - x_n)/(x_{n-1} - x_n^*) \qquad (5)$$

which is identical with the well-known definition of Murphree. Fig. 1 defines the quantities in this equation. As will be seen, the efficiency of a contact unit can never exceed 100 percent (the efficiency of the theoretical contact unit). The efficiency of a plate consisting of several contacts may also be calculated by an equation similar to Equation (5), as per definition. For instance, for a plate consisting of three contacts the plate efficiency would be

$$E_p = (x_{n-1} - x)/(x_{n-1} - x^*) \qquad (6)$$

where Fig. 1 again defines the quantities. It is evident that when a distinction is made between a contact unit and a plate, the plate efficiency can never exceed 100 percent (the efficiency of the theoretical or perfect plate).

The efficiency of a plate naturally depends on the efficiency of the contact units of which it is made. In addition, it depends on the mechanical or design features incorporated in the plate, such as the distribution of the bubble caps on the plate and, most important, the number of contacts. In referring to plate efficiency, the number of contacts should be mentioned.

On the other hand, if the performance of the plate of three contacts, used for illustrative purposes in Fig. 1, be compared with the performance of one perfect contact unit (the first one) the plate efficiency will be mathematically greater than 100. If such a comparison is to be made—as is the general practice at the present time—then it will be necessary to refer to a perfect contact unit as a standard or reference unit with a relative plate efficiency of 100. Then plate efficiencies greater than 100 are conceivable in a relative sense, with a significance entirely different from the plate efficiency defined above. This concept of relative plate efficiency is expressed in Equation (7):

$$E'_p = (x_{n-1} - x)/(x_{n-1} - x_n^*) \qquad (7)$$

The McCabe-Thiele and other methods are also applicable to screen type plate column calculations. Each plate, assuming that it were a theoretical plate, would be equivalent to a certain number of theoretical contact units. Again, as in the case of the bubble cap type plate, an absolute and a relative efficiency can be assigned to the plate.

It is evident that one has the choice of using as a yardstick either the absolute, or the relative, plate efficiency concept. However, the difference between the two should be clearly understood and the practical value of each appreciated. As far as the column calculations are concerned, it appears to be immaterial whether absolute or relative efficiency is used. However, a relative plate efficiency is in no ways indicative of the performance efficiency of the plate. An approximate picture of the plate performance is, of course, obtainable from the relative efficiency, if the number of contacts is known. From another viewpoint it is necessary to be able to compare the performance of the plate with that obtainable were the plate perfect. In this connection, the Murphree efficiency (i.e., the efficiency of a single contact unit) supplies valuable additional information.

Summing It Up

1. It is suggested that a distinction be made between a theoretical contact

unit and a theoretical plate. A theoretical plate will be one which consists of one or more theoretical contact units. In plate column calculations it will be the number of theoretical contact units which is determined as the first step.

2. It is suggested that a distinction be made between contact efficiency and plate efficiency. Both efficiencies are expressable with an equation of the Murphree type. The contact and plate efficiencies are as represented in Fig. 1, and therefore plate efficiencies greater than 100 (the efficiency of the theoretical or perfect plate) are never obtainable.

3. In plate column calculations, to make the method of calculation applicable to both bubble cap plate type and screen plate type columns, it is suggested that the concept of relative efficiency be employed. The efficiency of a perfect contact unit on the relative efficiency scale will be 100. It is suggested that in this case the perfect contact unit be referred to as a standard or reference plate.

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Avoiding Destructive Velocity Through Adsorbent Beds

EDWARD LEDOUX

Attapulgus Clay Co., Philadelphia, Pa.

Excessive gas velocities through adsorbent beds produce motion of the adsorbent particles in the upper layers of the bed, resulting in their reduction by abrasion to sizes small enough to be carried away by entrainment. Mr. Ledoux shows how this action takes place under various bed and flow conditions. He then derives a dimensionless expression for the maximum safe gas velocity which can be used as a guide in the design of systems for various gases, adsorbents, and P-T conditions.

IN MANY existing industrial adsorption installations, excessive adsorbent consumption is directly traceable to excessive velocity of gas flow, which causes entrainment and the breaking up of the granules. This is particularly true in the case of high pressure units.

Excessive impact of the gas on the granules sets the latter in motion. This effect is more pronounced in the top layers of the bed where the granules are subject to less pressure from the layers above them. The continual churning of the adsorbent at the top of the bed results in powdering by abrasive action, and also its entrainment into the gas flow. These effects are shown schematically in Fig. 1.

In Fig. 1a a bed is shown in which the mass velocity is not too high. Here the top screen rests uniformly on the entire cross section of the bed and no movement of granules occurs. Fig. 1b suggests what happens after a bed has been subjected to an excessive velocity for some time. The top surface of the bed does not remain flat and horizontal. In spaces between bed and screen the granules are churned and reduced to powder which sifts through the screen. Some of the smaller particles escape directly through the gap between screen frame and wall. If the screen is fixed, as in Fig. 1c, this last effect does not take place but the space between bed and screen increases because the screen

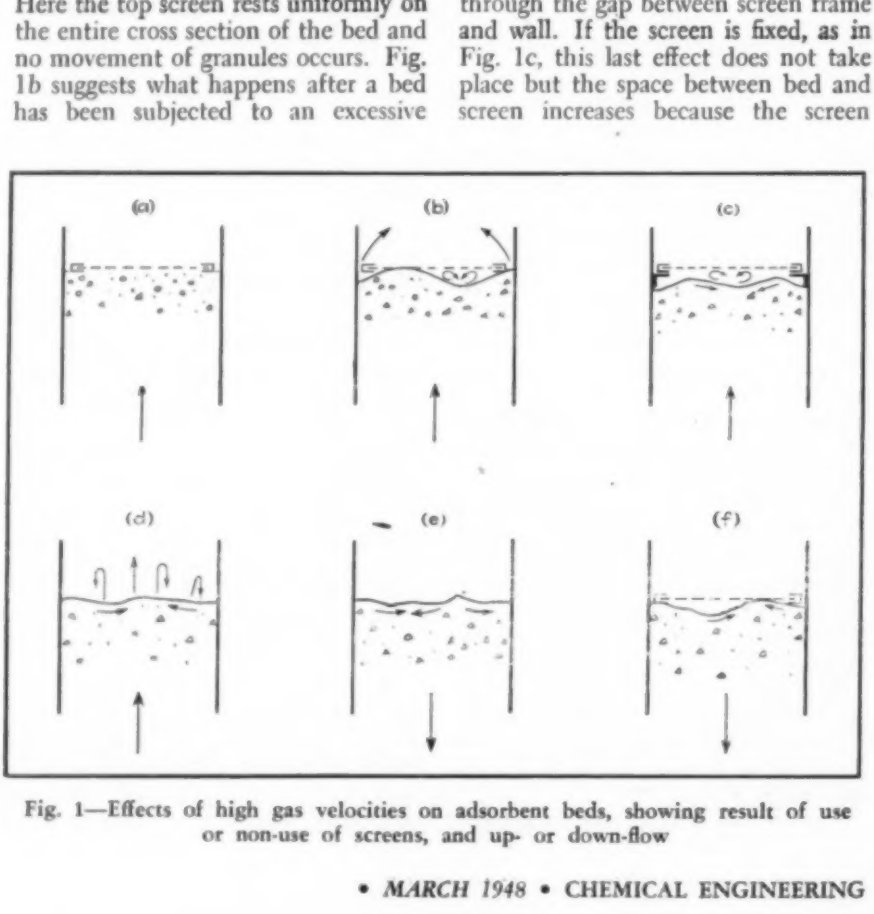

Fig. 1—Effects of high gas velocities on adsorbent beds, showing result of use or non-use of screens, and up- or down-flow

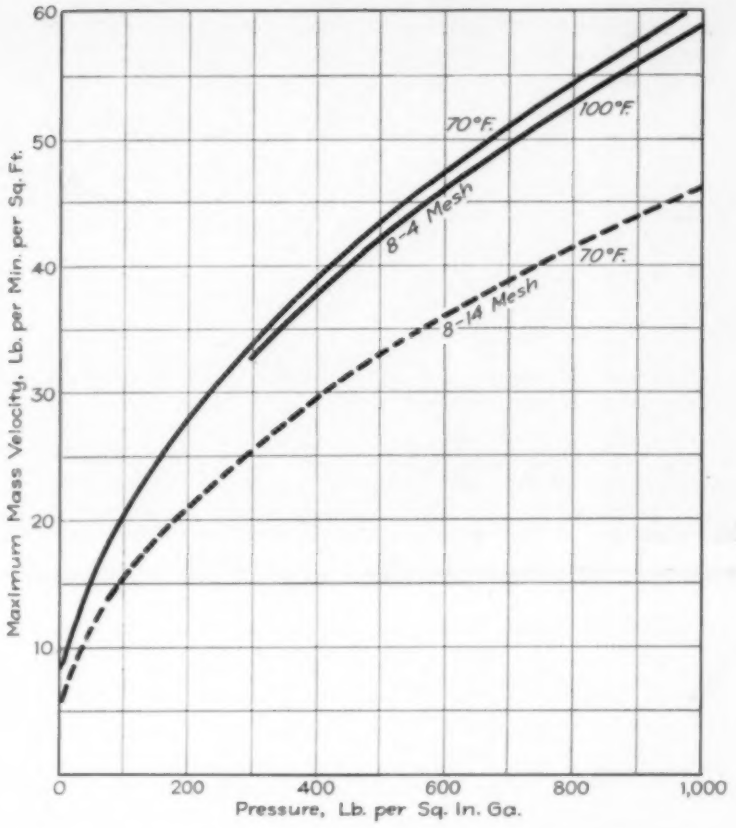

Fig. 2—Maximum mass velocity for natural gas through bauxite at various temperatures and pressures, assuming perfect gas laws

does not follow the shrinkage of the bed. Therefore, destruction of the granules is still more rapid. Fig. 1*d* shows a bed without a top screen. In this case the smaller granules are lifted and some of them fall back until abrasion has reduced their size enough for entrainment. In all these cases, granules migrate laterally in random fashion at the top of the bed. With downward flow, as in Figs. 1*e* and 1*f*, there is no lifting but the disturbance of the bed surface and lateral migration remain.

Flow Direction

With counterflow regeneration of the adsorbent bed[1,2] the zone of granule movement will reach farther down into the bed than in the case where both adsorption and desorption flows are in the same direction. This arises from the fact that settling of the bed is disturbed at each change of cycle, particularly if the regeneration time is short and the regeneration flow consequently is high.

To avoid trouble in operation the mass velocity must be kept below a certain maximum value which depends upon several factors. Let us apply the principle of dimensional similitude[3] to the determination of the expression of the maximum mass velocity G. The factors certainly involved in the magnitude of G are the density of the gas d_g, the average particle diameter D, the acceleration of gravity g, and the density of the adsorbent particles. In view of the condition of similitude, the latter may be replaced by the apparent density of the adsorbent bed d_a. The influence of viscosity is insignificant because the actual velocity past the granules is great enough for the viscous drag to be negligible, compared to the forces of inertia.

The dimensions of these quantities are: $G = M/L^2\theta$; $d_a = M/L^3$; $D = L$; $g = L/\theta^2$; and $d_g = M/L^3$, where M, L and θ are respectively the fundamental units for mass, length and time.

Assume a general dimensionless group Z of the form $Z = d_g^a\, d_a^b\, G^c\, D^d\, g^e$. After substitution of the dimensions this becomes

$$0 = \left(\frac{M}{L^3}\right)^a \left(\frac{M}{L^3}\right)^b \left(\frac{M}{L^2\theta}\right)^c L^d \left(\frac{L}{\theta^2}\right)^e$$

For the exponents to be dimensionless, the following relations must obtain

$$\Sigma M = 0 = a + b + c$$
$$\Sigma L = 0 = -3a - 3b - 2c + d + e$$
$$\Sigma \theta = 0 = -c - 2e$$

Solving these equations yields: $b = -a + 2e$; $c = -2e$; and $d = e$. Then substitution in the expression of Z gives

$$Z = d_g^a d_a^{-a+2e} G^{-2e} D^e g^e = \left(\frac{d_g}{d_a}\right)^a \times \left(\frac{d_a^2 Dg}{G^2}\right)^e$$

Other conditions being equal, that is to say for a same adsorbent density and particle diameter, the lifting and churning effect is determined by the dynamic pressure of the flowing gas. The dynamic pressure is $d_g V^2/2g$ where V is the linear velocity through the bed. In terms of mass velocity it is $G^2/2gd_g$. For conditions to remain the same when the density is changed, we must have $G^2/2gd_g$ = constant or G^2/gd_g = constant. Inspection of the expression of Z above, in the light of this condition, shows that we must have $a = e = -1$ and Z = constant. Hence the general expression

$$G^2/d_g d_a Dg = \text{constant}$$

Experience with industrial beds and upward flow of air at atmospheric pressure shows that the value of the constant is 0.0167. Thus, the maximum mass velocity for different adsorbents and gases at different conditions of temperature and pressure may be determined by

$$G^2/d_g d_a Dg = 0.0167$$

The fraction being dimensionless, this relation can be used with any consistent system of units. For the less economical downward flow,[2] the value of the constant is most probably higher but has not been determined.

Fig. 2 shows the application of this formula to the case of bauxite and natural gas on the basis of the perfect gas law.

Formula Limitations

It is important to note that this formula applies to dimensionally similar beds. In practice, all batches of granular adsorbents of same mesh range will not present exactly the same screen analysis (which is required by the principle of similitude). In other words, two batches of 8-4 mesh (for example) will not be strictly similar inasmuch as they will contain different percentages of coarse, medium and small particles. Furthermore, even if the batches were identical in screen analysis, the arrangement of granules in the bed after charging would be different. For these reasons, the maximum velocity given by the formula does not represent a clear-cut limit and design velocity should be taken conservatively lower.

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ACETONE → and RESIN

Vinyon N

EDITORIAL STAFF

VINYL CHLORIDE—acrylonitrile fibers are an improvement over the older vinyl fibers; and moreover possess that combination of vinyl properties which make them outstanding: high strength and great toughness, nonflammability, exceptional chemical resistance, negligible water absorption, and immunity to rot and mildew. It is now known that Vinyon N resin is superior in the very properties in which vinyl chloride-acetate resin is weakest. Vinyon N is a product of the Carbide & Carbon Chemicals Corp.

Fibers can be spun by simple processes involving cheap solvents and, with few exceptions, ordinary equipment. The copolymer resin used for their manufacture at the present time contains 56 to 60 percent of vinyl chloride. It is converted to fiber or yarn by either the dry or wet spinning process.

Vinyon N fibers are applicable for usage in a diversity of fields. With its outstanding resistance to acids and alkalis, it appears to offer a new material for the chemical process industries and other industrial usage. It is expected to be widely used for indoor draperies, household use, children's dresses, bed clothing, oxygen tents and many other purposes.

Carbide & Carbon is producing the fibers in a small plant at its Charleston, W. Va., works. Vinyl chloride-acrylonitrile resin in finely divided form, acetone and a small amount of stabilizer are brought together in a dough mixer. Temperature is raised while agitating the dough-like mix under a nitrogen atmosphere of 50 lb. per sq.in. The dope is passed through a strainer into a receiving tank.

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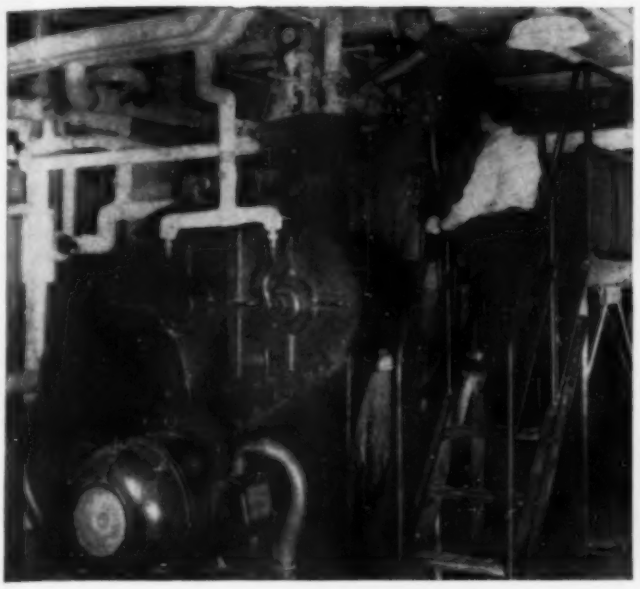
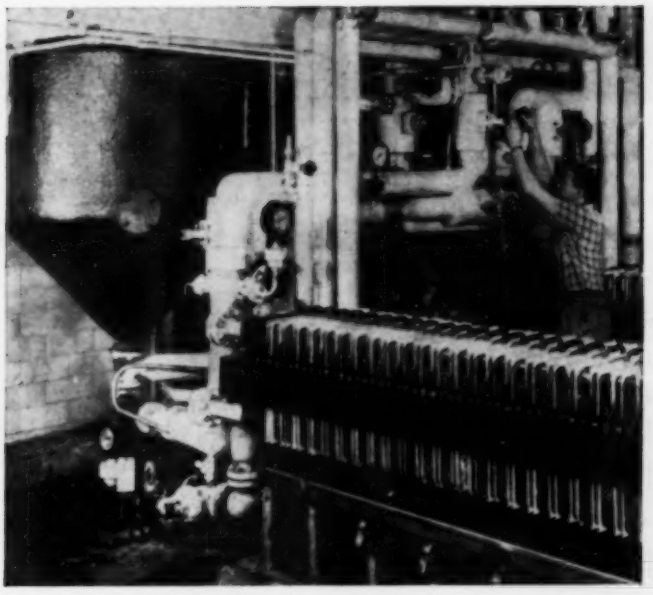




are MIXED → and FILTERED → FIBER is spun ↓

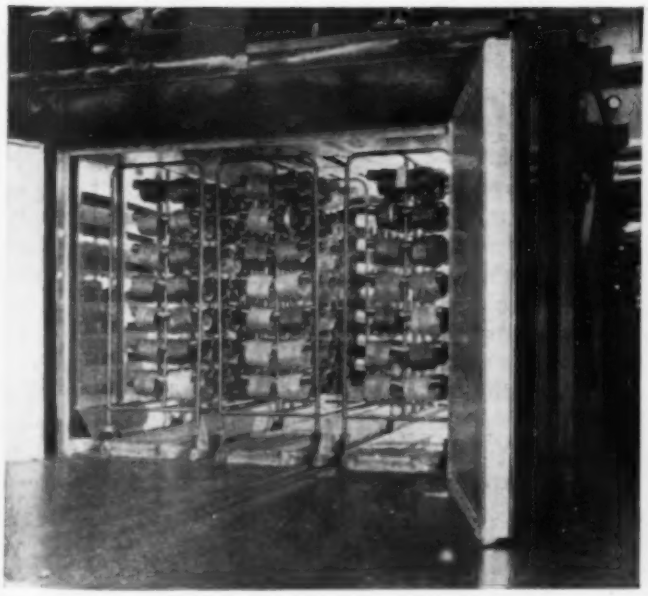
From here it goes through two plate and frame filter presses. Next it is pumped to a feed tank. From this tank the dope is circulated through the spinning machine header.

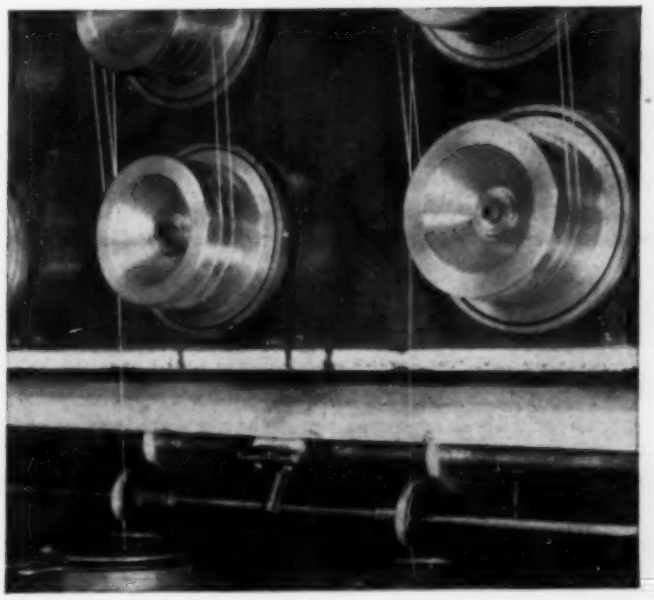
Filaments are formed by extruding dope downward from the top of the spinning machine through the stainless steel spinnerette. The acetone is evaporated by a blast of hot air rising through the 20-ft. high spinning cell. A metering gear pump regulates amount of dope extruded in each spinnerette.

Spun yarn is stretched, usually 900 to 1,300 percent, in order to increase its strength. This operation is done in a steam tube at 120 deg. C. After twisting, the yarn goes through a process of stabilization by being exposed to hot circulated air in an oven. This reduces shrinkage in boiling water. Following this action are the usual operations given textile fibers.

Stainless steel is used for almost all equipment. Dope temperatures are maintained between 75 and 90 deg. C. It is kept under nitrogen atmospheres.

HEAT TREATED ← LUBRICATED ←





EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

IN TRIBUTE TO OUR FOUNDER

We on *Chemical Engineering* owe a special debt to the late James H. McGraw, who died last month in his eighty-eighth year. He had been a great teacher as well as publisher and leader of men. There are countless thousands —if not millions—of men and women in industry who owe some measure of their education and success to the magazines and books he caused to be published.

But those of us who were privileged to work with him gained most from his strength and example. He set high standards for himself and all who were associated with him. His dissatisfactions were many, but they were also wholesome and stimulating. There was never a pat on the back without the challenge to strive for a still higher goal. He never compromised with expediency when there was a job to be done for an industry, trade or profession.

Because Mr. McGraw believed so thoroughly in the contributions electricity and chemistry were destined to make to the advance of American industry in this Twentieth Century, he joined with a small group of pioneers in founding this magazine in 1902 as *The Electrochemical Industry*. His slender funds were its sole support in the early days. But backed by his virile interest, energy and enthusiasm, the new publishing venture soon prospered and expanded in scope and influence. Then for more than three decades he closely followed every issue, sharing with us in our editorial problems and progress. On the occasion of our last visit in August, 1946, he vividly recalled all the several changes that had taken place in this magazine's name and field. He welcomed *Chemical Engineering* as the attainment of a cherished goal—but also as an opportunity to help in building a still greater profession.

For these memories—and many more—we pay humble tribute to our founder. Still ringing in our ears are his favorite words from Browning—"Man's reach his grasp must ere exceed, Else what's a Heaven for?" His example will continue to inspire all of us to reach for ever higher goals.

Sidney D. Kirkpatrick

BILLIONS FOR SYNTHETIC OIL?

Secretary Krug's proposal of a $9 billion program for governmental development of synthetic fuel need not be taken too seriously—yet. A few well informed petroleum executives with sharp pencils and sharper intellects were very quick to point out the impossible burden it would place on our economy. There is not enough steel or coal miners to do the job. Nor are we ready technically for such a program. There is still a great deal of fundamental work to be done by Mr. Krug's own Bureau of Mines. There is much to be learned by industry in its privately financed plants for the production of liquid fuels from natural gas. These undoubtedly point to the shortest immediate route for producing synthetic fuel. But in the long run, this is not going to be the main route. For the years immediately ahead, our scarcity of liquid fuels must be met by increased imports of foreign oil although ultimate solution undoubtedly lies in converting solid to liquid fuel.

YOUR TAX-EXEMPT COMPETITOR

We have a growing fear that the taking and holding of patents by quasi-public bodies is leading us into a serious controversy between industry and education. We refer particularly to certain research institutes that are affiliated with educational and scientific institutions which by law are "non-profit" organizations. Lately, several industrial executives have cited cases in which the non-profit features of such institutions have been used to develop an unfair relationship that is competitive with profit-making, tax-paying corporations. It is evident that increased suspicion of this sort may develop into active criticism. When that happens, a major source of support for the institutes will be gone.

There is, in our opinion, a place for properly restricted, independent research agencies. But such an agency must not become a competitor of profit-making business. And it must not become a drag on educational institutions by depriving them of their better teaching talent through diversion from first-class teaching into second-class researching.

WHOSE JOB?

Recently the research director of one of the big companies in the process industries set up a special unit to advise with the company's purchasing department. It has been organized to give the same long-view experimental study to purchased raw materials as the other research divisions give to plant processes and products.

This is an interesting idea. We are not sure whether it is generally applicable or not. In fact, we doubt if it is. But the principle which underlies the action is certainly sound. We refer to the fact that raw materials must be investigated with the same objectivity and long-time viewpoint as are production methods and customers' needs.

Substitution of new raw materials and improvements in old ones go on apace. A company which ignores the possibility of such changes is not wise. Whether the research director does it, or a research-minded purchasing agent, is not important. But whether the job is done well or not is or may become a vital factor in determining future earnings.

MORE OR BETTER PATENTS?

SUBJECT to criticism from many sides, the patent system has taken quite a beating in recent years. Today a great part of the criticism is directed at the time lag between patent application and issuance. Although such criticism is of the Patent Office, too often it forms the basis for attacks on the system as a whole.

The backlog of cases awaiting action has now grown to 150,000—fully a two-years' load. It is still growing. In a recent article in the *Journal of the Patent Office Society*, H. B. Whitmore, one of the examiners, undertakes to explain causes and remedies for the situation.

By studying trends in Patent Office actions, Whitmore concludes that the present jam is largely the result of delay in increasing the forces of the office. He builds his case well. The flood of applications that began in 1943 came at a time when the number of examiners was at its lowest ebb. A corresponding increase in the number of examiners was not started; it is just beginning now. Since it takes time to train patent examiners, these new men will not show concrete results for many months.

What remedy might lead to an immediate reduction in the patent jam? The only possibility is to reduce the quality of the searches. This means that the quality of issued patents would suffer. The inevitable result would be more criticism of the patent system as these poor patents begin to flood the courts a few years from now.

Whitmore holds that the solution is "for all involved to grit their teeth and hold on a little longer." The situation will get worse before it gets better; but as the new examiners learn their jobs, the backlog should begin to drop. The Office is taking vigorous steps to speed the training of the new men.

Above all, the quality of issued patents must be maintained, if not improved. If that means more time before the big backlog is shaved down to normal size, we are willing to wait.

THOSE NEW RUBBERS

ESTABLISHMENT of a permanent synthetic-rubber industry in America is of utmost importance. But a mere freezing of plants and processes would be worse than futile. Arrangements must be made to provide for constant change, and the prompt application of new technology on a commercial scale.

Chemical enterprise has done a marvelous job in manufacturing GR-S and other special synthetic rubbers. Some of these equal and others excel natural rubber in performance for many, if not most, purposes. A return to natural rubber exclusively is unthinkable. We should consider as equally undesirable a freezing of technology on the present basis, good as it is.

Even now there are a dozen significant improvements in chemical-making, in formulas, and in methods of polymer formation—all struggling for recognition and adoption. Currently, Rubber Reserve is trying out low-temperature formation of copolymers. Elsewhere in this issue are described some significant developments along this line that have come from the research and development laboratories of Phillips Petroleum. In both instances the results seem to promise a very important advance in quality of product without corresponding increase in cost. Other improvements are coming along month after month and year after year. Basically, this proves beyond doubt that whatever Congress does in establishing a national rubber policy, its legislation will be inadequate unless it provides for continuing change in our plants and processes, products and technology.

NEW ENGLAND'S TVA?

CONTROVERSY over the development of the St. Lawrence seaway again spotlights the old question of power vs. navigation. Which is the main objective and which is the byproduct? Frankly, we do not know in this case, nor in many others. But we do know that this controversy is important to certain process industries.

If the St. Lawrence is developed, there will be a substantial shift in potential plant locations—some helpful, some detrimental to present plans arnd sites. Also, such development, however planned, will change energy-supply relationships in much of the area from Buffalo to Maine and from Ottawa to Quebec, or even beyond.

Congress may not reach a decision this year on this highly controversial issue. If it does, that decision will largely govern for a long time hence many of the transportation and power factors affecting our industries. In the last analysis, Congress will make its decision on these technical questions on the basis of political considerations. This means that each affected industry and region must be prepared to state its case in Washington if it wants to influence the legislative findings.

FOR MORE BUSINESS IN GOVERNMENT

FROM all the hemming and hawing over the mechanics of administering the European Recovery Program may have come a useful pattern for other governmental agencies faced with similar jobs. It makes good sense to hold the President and his Secretary of State responsible for policy-making decisions affecting our political and international relations. It is equally sensible that the actual running of the business program should be in the hands of experienced business executives. To do less than this may prove both wasteful of public funds and subject to needless social and political complications.

That there is growing appreciation of these facts is evident in quite a different quarter. For example, we have reason to believe that the National Security Board may have reached somewhat similar conclusions in connection with the purchase and stockpiling of strategic materials. This super-cabinet agency, named by the President but jointly responsible both to Congress and the Executive, has about reached the conclusion that the business phases of its program cannot be handled efficiently by career executives hired under and restricted by normal Civil Service regulations. Thus, there is likely to develop for strategic materials the same kind of businesslike working agency that is now most favored for ERP administration. When of necessity the government must embark on big business ventures, whether for foreign aid or national defense, we have the right to demand sound and businesslike methods in their administration.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

January Contest Prize Winner

SIMPLE MODIFICATION INCREASES ACCURACY AND EASE OF USE OF ORSAT TYPE GAS ANALYZERS

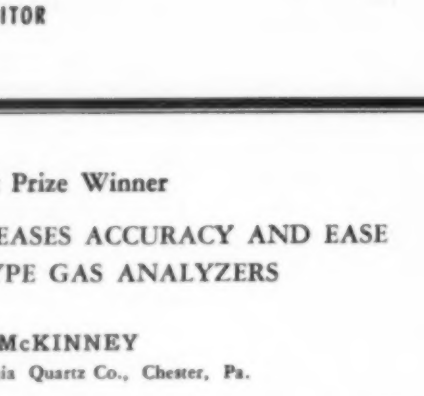
ALFRED H. McKINNEY
Chemical Engineer, Philadelphia Quartz Co., Chester, Pa.

SHOWN in the accompanying diagram is an apparatus embodying two changes over conventional leveling bulb procedure for measuring gas volumes. The first is the use of an adjacent parallel tube, instead of the leveling bulb, to determine when the sample being adjusted is at atmospheric pressure. The second change is the use of a conventional air pressure regulator to obtain the level variations. The system gives increased accuracy and ease of manipulation.

The air pressure on the regulator is adjusted until the liquid levels in the two tubes are parallel, the right-hand tube being open to the atmosphere. The level is more accurately adjusted in this manner, since the meniscus in each tube is itself level, and since the two meniscuses point towards each other and are self-indicating.

Tube *A* is a conventional gas buret. Tube *B* is approximately the same diameter as *A* and mounted parallel to it as closely as is convenient. Stopcock *C* is open during the leveling and closed when the gas in *A* is forced into the analysis bottles.

The pressure regulator should be supplied with clean, dry air at a pressure not too much above the maximum pressure wanted. For accurate adjustment and stability, it should be a force-balance type of regulator. A 50-in. Nullmatic regulator (Moore Products Co.) is best if the confining liquid is water; a 25-lb. regulator should do for mercury.



Adding leveling tube and pressure regulator improves conventional gas analyzer

If water is used as the confining liquid, it is usually nearly saturated with NaCl or Na_2SO_4 and made slightly acid. It is also useful to color it and add a wetting agent.

FEBRUARY WINNER

A $50 prize will be issued to

R. C. RAHN
Diamond Alkali Co.
Painesville, Ohio

For an article describing a means of continuous recording and controlling of the concentration of HCl which has been judged the winner of our February contest.

This article will appear in our April issue. Watch for it!

CROWDED STORAGE TANKS QUICKLY REPAIRED

AUGUST H. BAYER
Chief Engineer, A. M. Harris, Inc.
Cincinnati, Ohio

CALLED in to recondition two pickle storage tanks in the plant of one of the country's largest toilet soap manufacturers, the author's company found that the placement of the tanks, as shown in Fig. 1, made the repairs difficult, although not impossible. The tanks were 18 ft. in diameter and 35 ft. from the top of the cover to the ground. They were placed with a minimum clearance of only 2 ft. and were in a congested area where access could be gained on only one side for bringing up repair materials. It was found that tanks Nos. 1 and 2 both required replacement of the complete top three rings of plates, while the bottom rings needed only a little caulking of the rivets, and tank No. 3 needed no work at all.

The tank arrangement made it necessary to develop a special method of handling the already rolled mild steel plates, and of removing the damaged plates. For this purpose a revolving trolley beam was constructed and installed as in Fig. 2. It was first used in repairing tank No. 1, and then moved to tank No. 2. After the first tank was completed, a second trolley beam was installed, as shown, between the first and third tanks for bringing material in between the tanks. Work on the tanks was facilitated by building two special scaffolds, one used inside, the other outside the tanks. A pair of hangers was fabricated to support simultaneously both of the scaffolds and a pair of chain blocks which were used in lowering the cut-out plates and in helping to raise the new ones into position for arc welding.

The tanks were repaired without removing the covers by the expedient of cutting out and replacing a section of the shell at a time. In Fig. 2 the solid lines indicate the outlines of the original riveted plates, and the dotted lines the outlines of the new plates which were butt welded in. Procedure was as follows: Starting at the lower edge of the angle band at the top of the tank, the portion of the old shell *ABGFEDA* was burned out. Before the cut was made, an angle clip was welded on to this portion for lowering by means of the two chain blocks.

Then a pre-rolled 6 x 12-ft. piece of

Based on a study submitted by the author to the James F. Lincoln Arc Welding Foundation in its recent $200,000 Design-for-Progress Award Program. This program called for papers on advances and improvements effected through use of arc welding in design, fabrication, construction and maintenance.

¼-in. plate was moved in with the revolving trolley, located and tack welded in place. The next step was welding the edge *BG* continuously on the outside, after which the second ¼-in. plate, 6 x 10 ft. in size, was lifted and welded from *H* to *E*, and along the top to the angle band. A tack weld was now made from *A* to *B* and a further portion of the old shell was cut out, from *D* to *J* to *F*. The third plate was now hoisted into place and continuously welded along sides *DJ*, *DE* and *EF*. Having now finished the "first phase" of the replacement, the same procedure was repeated until the entire circumference of the tank had been replaced.

After all outside seams had been welded continuously, the inside was welded likewise, and then a second bead was welded on to the outside seams. After moving the scaffolds and the revolving trolley beam, and installing the second trolley beam between the first and third tanks, the repairs for tank No. 2 were conducted exactly as before. The entire costs, including materials, labor and all overhead items came to $2,093.72 for the first, and $2,491.22 for the more difficult second tank. By comparison, two similar new tanks installed would have cost $14,235.80, or $9,627.86 more than the repaired tanks, which are believed to have as good a life expectancy as new.

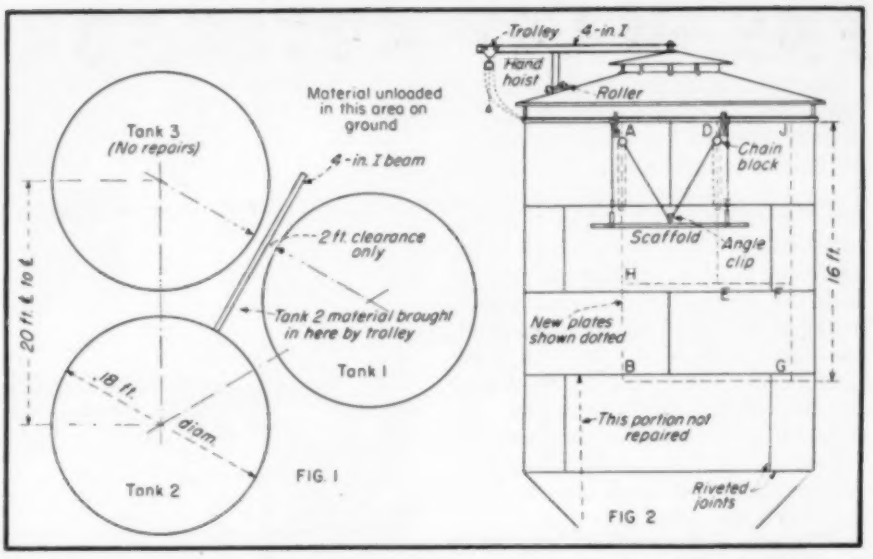


Fig. 1—Arrangement of tanks, showing crowded placement

Fig. 2—Tank and rigging, showing procedure used for repairs

SIPHONING ARRANGEMENT FOR PROCESS VESSELS

WALTER G. THOMSON
Minnesota Mining & Manufacturing Co.
St. Paul, Minn.

A CONVENIENT and easy way of starting a siphon between process vessels is shown in the two accompanying sketches. Fig. 1 shows the simplest way of starting a siphon from vessel *A* to vessel *B*, while Fig. 2 is a development of the basic idea, for use where none of the siphon-starting liquid must be permitted to run back into vessel *A*.

In Fig. 1, the reservoir is filled by closing valve (1) and adding water via valve (2). To start the siphon, valve (2) is closed and valve (1) opened. Air, being lighter than water, rises through the pipes to the top of the reservoir. This permits the water to trickle down into the pipes. As soon as the water in the pipe to vessel *B* reaches sufficient height, siphoning will start.

In Fig. 2 it will be evident that water from the reservoir will be unable to rise any higher than the tee leading to valve (1). A sight glass is a desirable addition to the reservoir, to make certain that there is enough water to start the siphon, and to tell when the

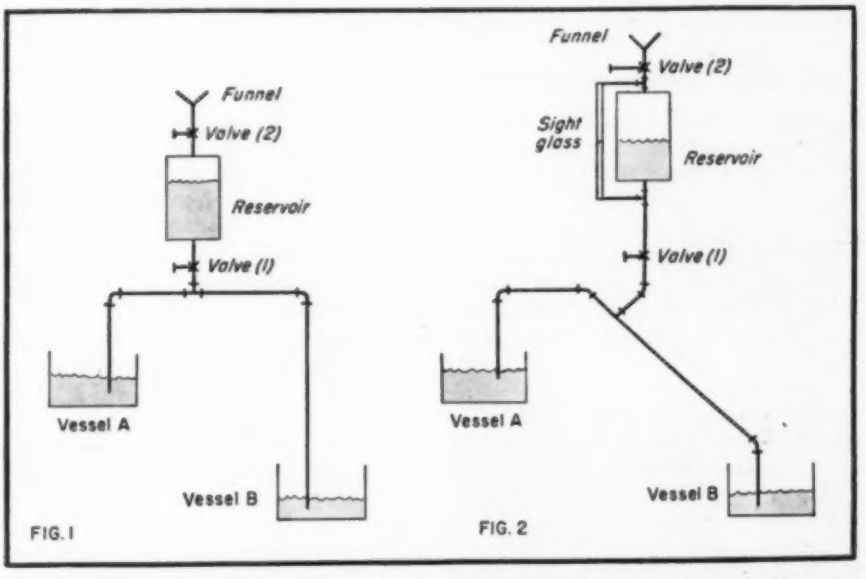


Fig. 1—Basic arrangement for starting siphoning from *A* to *B*

Fig. 2—Siphon starter that excludes water from vessel *A*

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the March winner will be announced in April and his article published in May. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

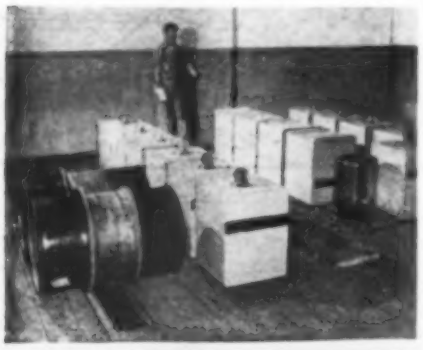
siphon has started by showing that the required amount of water has drained out.

Such arrangements are useful in the case where it is impractical to put a bottom drain in the vessel because of its type or construction, its material of construction, or some similar reason. Another case would be where the pipe and valves in the pipeline would be so badly corroded by prolonged contact with the liquid that a normal piping arrangement could not be permitted. In a case such as the last the sight glass is most useful since, by regulating the amount of water drained from the reservoir it is possible to start the siphon and yet have none of the liquid being transferred from vessel *A* to vessel *B* touch valve (1).

Although water and air have been designated as the liquid and gas present in this system, it is obvious of course that many other substances would work equally well.

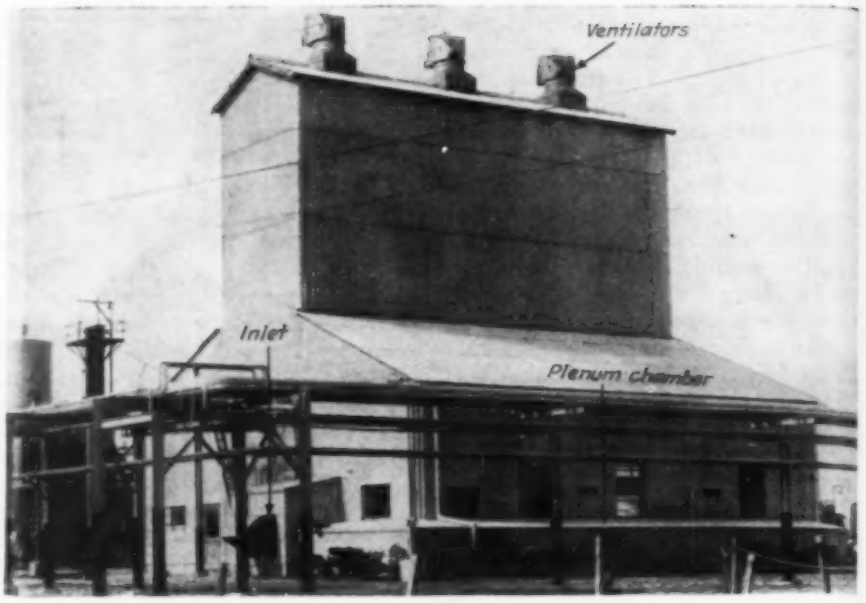
SPEEDING CARBOY HANDLING

ASSEMBLY-LINE principles are being used to achieve faster turn-around of chemical containers at the plant of Heyden Chemical Corp. at Fords, N. J. Under the new set-up both carboys and drums when returned for re-use are cleaned, washed, filled and refurbished in an almost continuous operation at an important saving in time.



Top—Here drums and carboys are washed, rinsed and dried

Bottom—Filling station provides fill pipe, scale and vent hood



Radiant heating is supplemented in this laboratory by air preheating in a plenum chamber, owing to heavy ventilation requirements

Damaged containers are removed by inspectors and the remainder go to a special rack where they are washed with high-pressure water, rinsed and then dried by an air blast. Carboys are further inspected with a strong light before being stoppered and stored for use. In refilling, special stations are employed where scales and outlet valves are provided. A hood, discharging to a suction fan, can be pulled down in case objectional fumes must be vented.

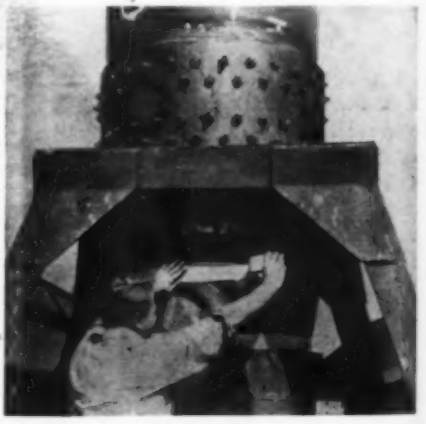
RADIANT HEATING USED IN EXPERIMENTAL BUILDING

NOVEL heating arrangements have been employed in Shell Chemical Corp.'s new general experimental laboratory at Deer Park, near Houston, Tex. Used now only for distillation work (with some office space), the building eventually will be employed for a variety of pilot plant work.

Primary consideration in the heating system design was the need to minimize fire hazards and at the same time to provide, when needed, as many as 60 air changes per hour (about 60,000 cu. ft. per min.). Normally the radiant heating system, which consists of hot-water-heated wrought iron pipe coils buried in the 8-in. concrete floor, can take care of requirements. However, in severe weather, the extremely high rate of air change makes this impossible and preheating of the incoming air is needed.

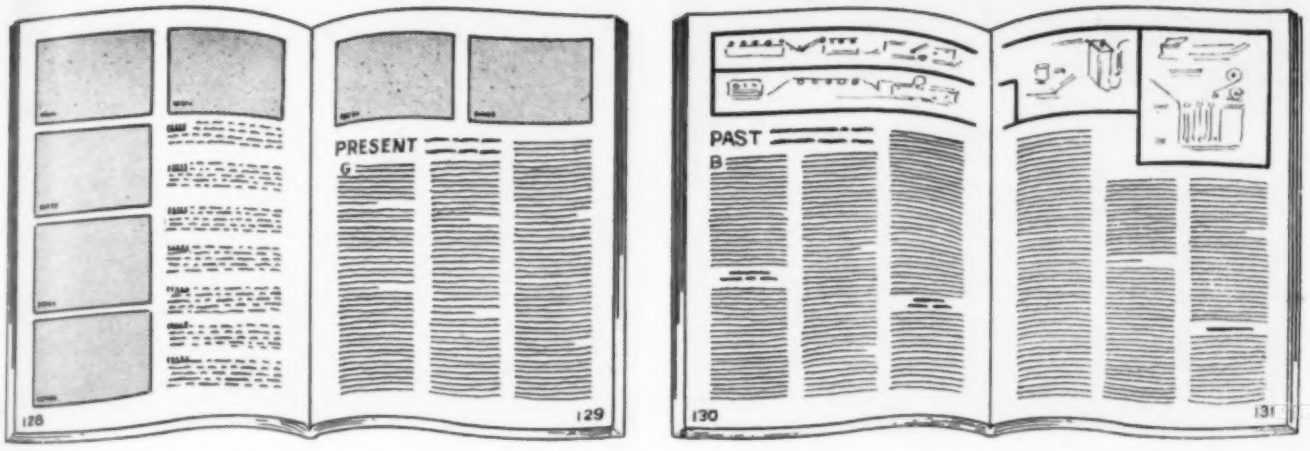
Preheating is provided by steam coils in a plenum chamber extending (as in the view) along one side of the building. There are louvered openings from the plenum chamber into the laboratory. When the system is in operation air is withdrawn by several 25,000 cu. ft. per min. roof fans, and is replaced by the preheated air drawn into the plenum chamber. Ventilation is mainly provided in the manner indicated, since the 52 x 52-ft. building of glazed brick and Transite on steel framing is lighted by fixed-sash windows.

This is said to be one of the few cases in the files of A. M. Byers Co., Pittsburgh, pioneers in radiant heat development, where preheating of the ventilating air has been found to be necessary.



Flexible Connector Uses Glass

A new method of making flexible connections in large ducts is indicated in the accompanying view showing a workman completing the connection in a 24-in fume stack for a steel pickling tank. A double-coated Fiberglas-backed adhesive tape (made by Bauer & Black, Chicago) is first applied to each portion of the stack, followed by a strip of rubber coated Fiberglas fabric to join the two parts. The final seal, as applied here, is a strip of Fiberglas-backed adhesive tape.



From Present Need . . . And Past Performance . . . You Would Expect a Brighter Future

A "Chem & Met" REPORT

Chemical Engineering in the TEXTILE INDUSTRY

FUTURE

That chemical engineering is needed is not enough; mills also must want it, be willing and able to pay for it

OFFHAND it looks like a golden opportunity for chemical engineers. Here is an industry, second only to the food industry in size, full of chemical engineering opportunities and not enough chemical engineers to say so. Bleaching, dyeing and scouring, for example, are all big business and are chemical engineering in their essentials. They involve the same old unit operations—filtering, piping, heating, cooling, drying, evaporating, mixing, blending, measuring, controlling—that chemical engineers have made themselves familiar with in their own industry. By and large these unit operations are being practiced by rule of thumb, without benefit of science, and by methods that, to say the least, could stand some bringing up to date. Nearly all the advances that have been made have come, not from the textile industry itself, but from the companies that supply the textile industry with dyestuffs, chemicals, machinery and instruments.

Why, then, do we say "offhand" it looks like a golden opportunity? What's to stop the enterprising chemical engineer who sees himself pitching into the textile business with a will? What do we see on second glance to give us pause?

First of all, we see an industry that, although tremendous in total, is made up of many, many small plants. A big percentage carry out purely mechanical operations, like weaving, and have no use for a chemical engineer. Of the rest, most are too small to keep a chemical engineer busy, no matter how much their wet processing operations could use one. Guesses vary, but people close to the industry don't seem to feel that there is room in textiles today for more than "several hundred" to "about a thousand" first class chemical engineers. The bright spot on this score is the trend, and it's a strong one, toward amalgamation. There are already a dozen or so big, vertical organizations. Each operates a string of mills to handle all manufacturing from raw fiber to finished goods. More such combines are in the making. Such organizations can keep a chemical engineering staff busy, but such organizations don't represent the bulk of the industry by a long shot. It still holds that our enterprising chemical engineer must be careful not to look for golden opportunities in an organization too small to support him and his programs when these easy-money boom days are over.

Second, we see an industry that has known hard times and may know them again. During the prosperous twenties the general philosophy was to get while the getting's good, and no nonsense about plowing back. When the bottom dropped out in 1929 the industry was caught with old equipment, old methods, and no reserves to fall back on. Competition became cutthroat during the thirties. Lots of mills went under and the rest were not far from it. Even if they had wanted to experiment with better methods they didn't have the price. Today the picture is brighter. Textiles made money during the war. Financially,

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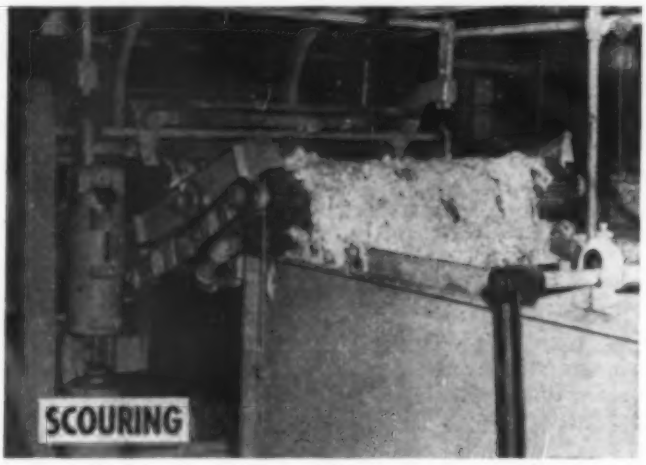


DYEING Could instrument control as well as record temperature? is it worth it? What's best way to get salt to kettle, as brine or as crushed rock? Would it save time to preheat bath? go to continuous process? enlarge drain and feed pipes?

BLEACHING Couldn't kiering (see cut) be stepped up at least a little by studying continuous processes? what's basic reason continuous range does same thing faster? Which of the various continuous processes is best suited to particular mill?

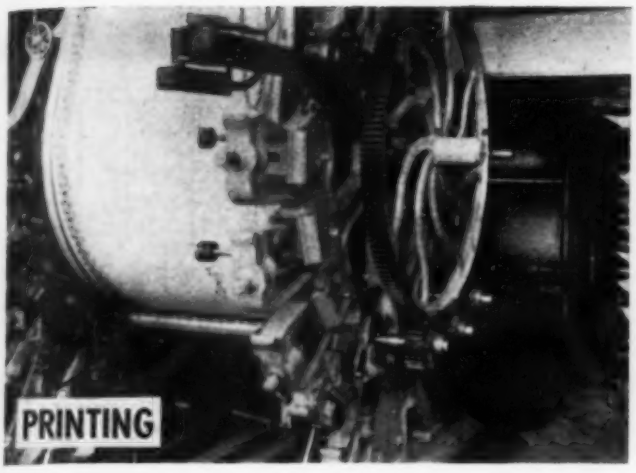
PRINTING What's the best paint for an acid ager (chamber full of acidified steam)? what's most foolproof steam-quality controller? How much would automatic paste cooker cost? save? Why no plant control? no real analysis of costs per yd. printed?

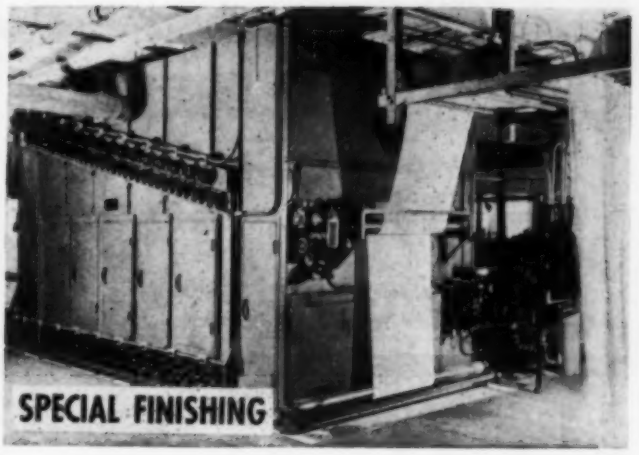
SPECIAL FINISHING What with so many new finishes wouldn't a pilot plant pay its way? give an edge over competitors? Could pad-steam method be applied more widely? What is best time-temperature cycle for curing resin treated fabrics?

SCOURING In scouring raw wool (see cut), what is optimum bath composition? is pH control enough to hold composition? Is countercurrent principle being used for all it's worth? Has any recent work been done on solvent scouring of raw wool?

WATER TREATMENT Could water demand be reduced? any wash water be reused? Would it be cheaper to soften hard well water or clarify turbid river water? Would it pay to put a settling tank ahead of filter? pipe strainer ahead of pumps?

WASTE DISPOSAL Would dye wastes cancel each other if properly compounded? Is it feasible to pump some wastes down deep well? How about new hypochlorite process for recovering wool grease? could old acid cracking equipment be adapted?





PRESENT

At least seven mill operations abound in chemical engineering problems, unanswered questions

THE place for chemical engineering in the textile industry is in the group of operations known as "wet processes"—as distinguished from mechanical processes like picking, carding, spinning and weaving. To the chemical engineer the most interesting wet processes are bleaching, dyeing, scouring, printing, and applying special finishes (like fire retardants, shrinkproofing, water repellants). These wet processes are concentrated in the section of the industry called "finishing," which means everything that comes after weaving. Important wet processes that come before weaving, and are not therefore classed as finishing, are the scouring of raw wool, package dyeing, and stock or skein dyeing of wool.

The fibers that the chemical engineer is most likely to be working with are cotton, wool, and rayon. No others, including silk and the new synthetics, have much to offer tonnage-wise.

Not all of the wet processes are applied equally to each of the fibers. Some cotton is packaged dyed, but the bulk is dyed as piece goods. (A package is a spool of yarn wound on a perforated cylinder or a spiral spring; "piece goods" are long lengths of woven cloth 2-4 yd. wide and 300-600 yd. long.) Of the finishing operations, bleaching, dyeing, printing, and occasionally special finishing are applied to cotton. (Bleaching, in the cotton trade, means not only the removal of color but also two preliminary steps: removal by acid or enzyme wash of the starch sizing put on to assist weaving, and removal of the natural waxes by boiling with caustic soda in a pressure vessel called a kier).

On wool, chemical engineering starts with the scouring of raw wool (washing with alkali and detergents to remove natural fats and greases). It is common to dye wool fiber before spinning and to dye yarn, either in skeins or packages, before weaving. Finishing operations are scouring (to remove oils put on to lubricate the yarn for spinning and weaving), then dyeing and sometimes special finishing.

Rayon comes from the manufacturer in good shape, so the chemical engineer will be concerned only with bleaching (occasionally), dyeing in the package or piece, printing, and a certain amount of special finishing.

All of these operations produce objectionable effluents and use tremendous quantities of water. Water treatment and waste disposal are therefore very definitely among the major fronts for chemical engineering attack. So is the recovery of values from wastes.

These are not the only wet processes that can use chemical engineering but they probably cover something like 80 percent of the opportunities. Three others that may come close enough to deserve mention are carbonizing, mercerizing, and slashing. Carbonizing is a process for getting bits of vegetable matter out of wool cloth; it is based on the fact that sulphuric acid, when dried on the cloth and baked, attacks vegetable fibers but not animal fiber. Mercerization is a process for increasing the strength, luster and dye affinity of cotton cloth; it is done by applying caustic soda to the cloth and heating while the cloth is held taut; no one is sure why it works. Slashing is the process of applying sizing to cotton and rayon warp yarns before weaving.

The average chemical engineer in the average mill should not expect, or be expected, to come up with anything revolutionary. He will pay his way if he only hunts for things to improve. His job will be to ask himself question after question, and one of the first will almost certainly be on the matter of control, or, more likely, the lack of it.

Why should a dyehouse dyeing the same fabric the same color day after day have 15 percent rejected for off-shade? What is out of control? How about water, temperature, pH, bath composition, corrosion, the operator? Could agitation or aeration have something to do with it? Anything else? And after all the variables are identified, how can they be controlled so that an order filled a month ago can be duplicated by setting the dials and no hit or miss? If the mill can't afford to make everything completely automatic, where will the money it has buy the most control.

In other directions he might ask himself: Is it true, as some people with no axe to grind are saying, that drying on cans (steam heated rolls) is out of date and far less efficient than air drying? What's the relation between the throughput of air dryers and their thermal efficiency? How are capacity and efficiency affected by the amount of moisture in the cloth, extent of countercurrent air circulation, temperature and moisture content of incoming air, same for outgoing air, rate of air throughput, specific heat of cloth, weight of cloth? How cheap must electric power be to make infrared drying competitive? Could cheaper power be obtained if plants had high-pressure boilers, using turbo-generator exhaust for process steam? Would it save much steam if dye kettles were covered? Would it pay to buy a colloid mill to make printing emulsions? What's the best way to get caustic out of mercerized cloth —neutralize it with acid, wash with bicarbonate solution, add CO_2 or SO_2 to the wash water? Would it pay to concentrate this caustic for use in the kiers? for reuse in mercerization? Can

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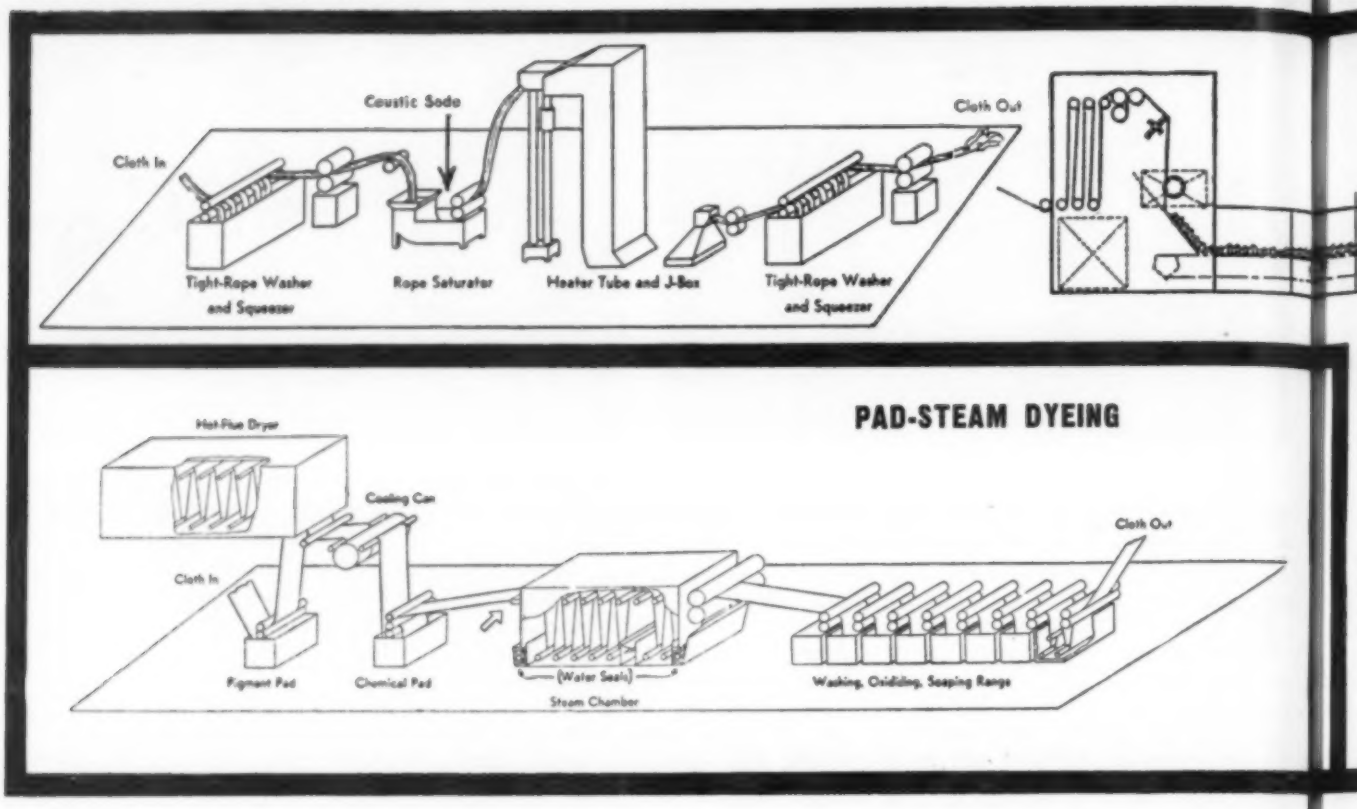


PAST

Examples of chemical engineering accomplishment show what it can do, show also that mills depend on their suppliers to do it

EACH of these is a product of chemical engineering. Of the chemical engineers responsible, two things are noteworthy: (1) They had, in addition to their chemical engineering principles, a thorough knowledge of textile fibers and fabrics; the fabric is only one more variable but it has to be mastered. (2) They were, with one exception, employed by companies outside the textile industry. It is a characteristic that the industry leans on its suppliers for engineering advancement, in the case of chemical engineering on the suppliers of chemicals, dyes, machinery and instruments.

CONTINUOUS BLEACHING

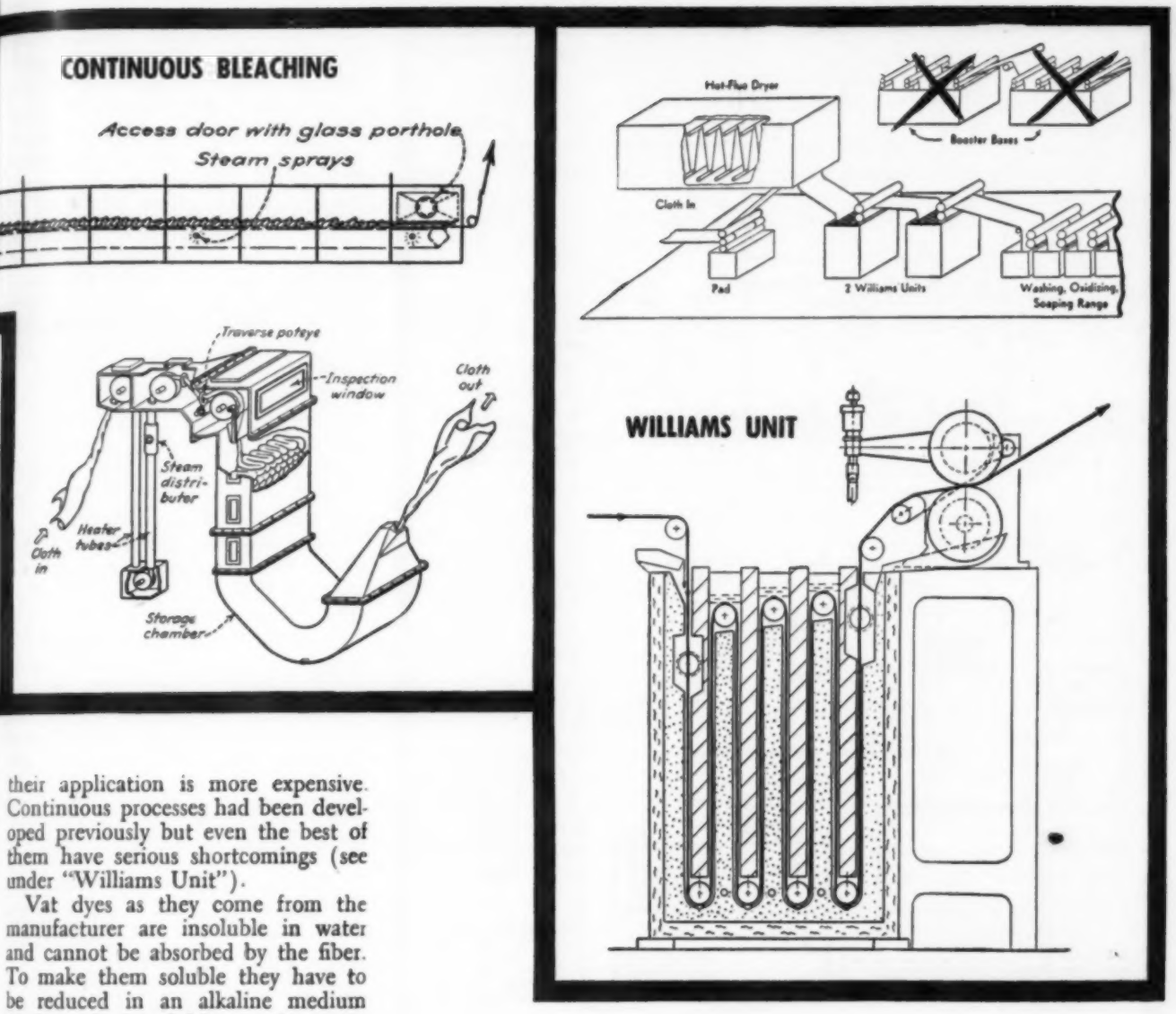
This and the continuous dyeing ranges are the most talked of developments in textiles today. They are probably the biggest developments since the thirties when stainless steel became available.

Up till now, two operations in the cotton bleachery have stood in the way of complete continuity. Kier scouring and bleach aging have remained batch operations. A kier is a pressure vessel. One of average size would be 7-8 ft. in diameter, 10-12 ft. high, and hold 3 tons of gray goods. To operate it they pile it full of cloth, clump the head down, evacuate all air, bring it up to 240-250 deg. F. and 15 psi. with steam, and spray a solution of 1-3 percent caustic soda and detergent onto the goods. The hot caustic percolates through the cloth and dissolves the natural cotton waxes and pectins. It is pumped out the bottom, reheated in an exchanger and sprayed back in the top of the kier. The boil takes around 8 hr., after which the cloth is pulled out, continuously washed and soured, then bleached. Bleaching was only semi-continuous at best, was commonly done in small batches on jigs, and usually consumed another 8 hr. at least.

Through the application of chemical engineering, the necessity for kiering and aging have been eliminated entirely. Du Pont, Buffalo Electro Chemical, and Mathieson Alkali have all developed systems that accomplish the same end more cheaply, continuously, and in 2 hr. instead of 16 or 20. Du Pont and Becco use J-boxes, Mathieson an endless belt conveyor in a long steam chamber, to do the work of the kier and the aging pit. The drawings show the Mathieson open-width steamer, the Du Pont rope type J-box, and a complete Du Pont scouring range. Ordinarily the scoured goods will go right on into a second identical range for bleaching, the only difference being the use of peroxide bleach solution instead of caustic soda in the saturator. Becco and Mathieson systems are exactly the same as Du Pont's in principle. Becco's J-box is a little different and Mathieson uses their steamer in place of the J-box, but fundamentally they all did the same thing. They found that under the right conditions it only takes 1 hr., not 8 or 10, for each of the reactions, scouring and bleaching, to take place; they developed a mechanism that could hold the goods for an hour without breaking continuity; they built an integrated system around their mechanism; and they clamped on controls that would hold the system to the "right conditions." In all three companies, chemical engineers are credited for spark-plugging the development. The new systems operate at 100-300 yd. per min., save up to 50 percent on chemicals, use about a third as much steam, and in one mill 6 men (2 per 8-hr. shift) bleached as much on one Du Pont open width machine as 18 men used to get out of 24 jigs.

PAD-STEAM DYEING

This process was developed by Du Pont chemical engineers for the express purpose of increasing the sales of vat dyes by making them easier to apply. Vat colors are the most durable dyes known for cotton and rayon, but they also cost more and



their application is more expensive. Continuous processes had been developed previously but even the best of them have serious shortcomings (see under "Williams Unit").

Vat dyes as they come from the manufacturer are insoluble in water and cannot be absorbed by the fiber. To make them soluble they have to be reduced in an alkaline medium (sodium hydrosulphite is the most common reducing agent). In this soluble "leuco" form the color is readily absorbed and held by the fiber. Thus "fixed," the color can be converted back to its insoluble state by passing the fabric through a mild solution of peroxide or other oxidizing agent.

Common practice is to reduce the vat pigment at 120-140 deg. F.; it takes 15 min. to an hour. For years it had been known that reduction would go faster at higher temperatures but many of the "leuco" derivatives are not stable at higher temperatures. More recently three important observations were made: (1) At 212 deg. F. reduction to "leuco" takes place in a matter of seconds; (2) at 212 deg. F. absorption and uniform distribution in the fiber also takes place in a matter of seconds; (3) for the few seconds involved, the "leuco" is sufficiently stable to stand 212 deg. F.

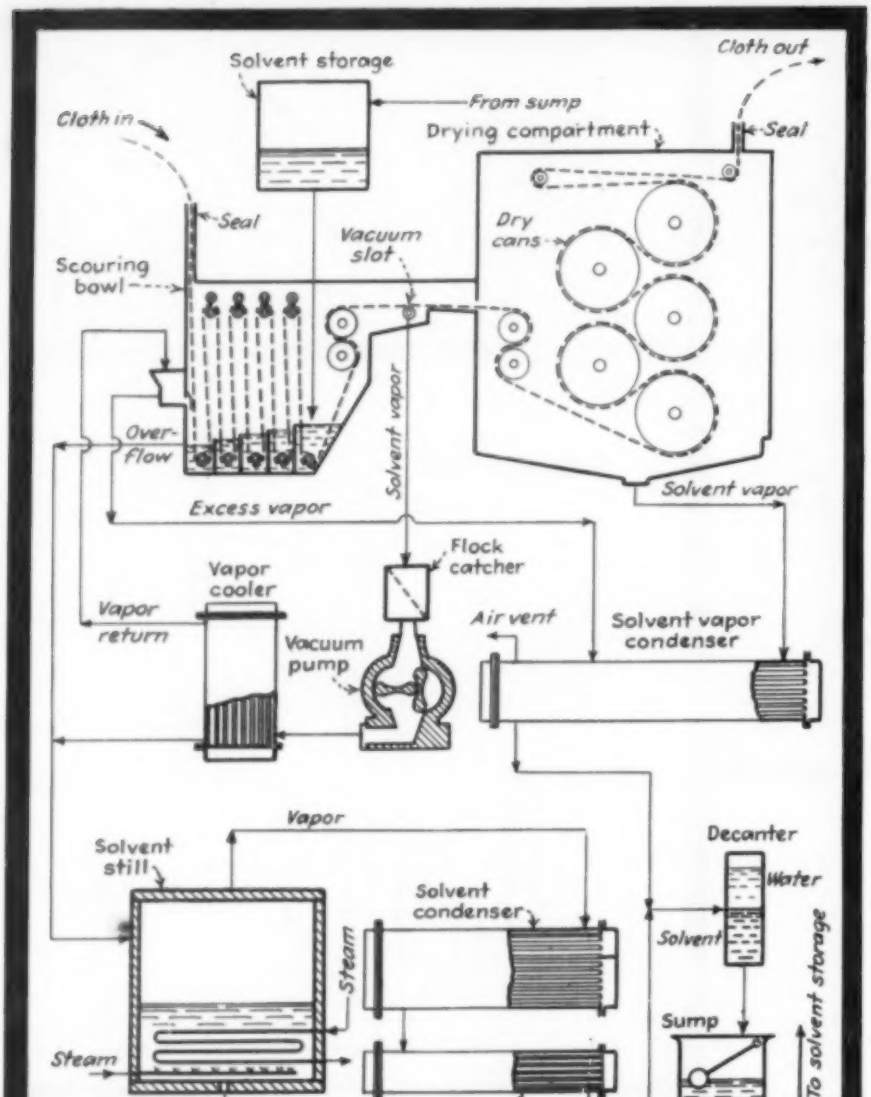
With these facts uncovered chemical engineering stepped in and developed the pad-steam process (thereby demonstrating one of the primary assets chemical engineers can bring to the textile trade—the ability to recognize significance in fundamental data and to apply fundamentals to a practical problem). The system they developed involves no unusual equipment but is rather an assembly of relatively orthodox equipment in a new, chemically engineered arrangement, under chemically engineered control.

The sequence of operations (as shown in the flowsheet) begins with the pigment pad. Here unreduced vat color is squeezed into the fabric. After the cloth is dried, it must be cooled enough to keep the chemical pad solution below the reduction temperature of the dyestuff. The chemical pad solution contains sodium hydrosulphite, caustic soda, and sufficient common salt to prevent color migration. Wet cloth enters the steam chamber and is steamed for less than 1 min. (sometimes as little as 10 sec.) at 212 deg. F. or slightly higher. A conventional washing, oxidizing and soaping train sends the dyed fabric off to the dryers.

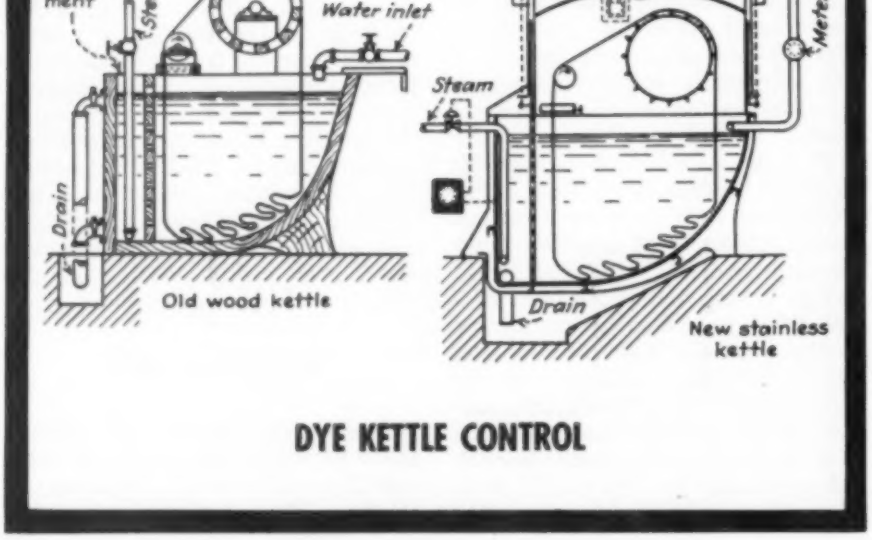
The pad-steam process is not the only new continuous range for vat dyeing but it is the only one using the "flash fixation" principle and it seems to have rung the bell in the industry. In comparing it with other processes —old or new, batch or continuous— one (non-Du Pont) man claimed that on any order over 5,000 yd. "it will do a better job than anything that will match it on costs, and it will do a cheaper job than anything that will match it on quality." Which we pass along for what it's worth.

WILLIAMS UNIT

There was something peculiar about continuous ranges that set General Dyestuff's S. H. Williams to thinking. The same job kept cropping



SOLVENT SCOURING



DYE KETTLE CONTROL

up over and over again. Cloth, moving in open width, had to be passed through some solution or other and squeezed out. Even in the few flowsheets shown here, that situation comes up at the end of pad steam dyeing and in the two big booster boxes in the range on page 131. If instead of using the Du Pont rope system, we had illustrated continuous bleaching with the Becco semi-open-width system, the Du Pont open-width system or the complete Mathieson system, the situation would have appeared many more times. Over and over again, it's a case of wet the goods and squeeze them out. It occurs in washing, saturating, scouring, oxidizing, reducing, leveling, boosting, soaping, rinsing, applying special finishes, dyeing, and probably a lot more.

Why not, thought Chemical Engineer Williams, design one versatile machine that could handle the situation wherever it came up? And while we're at it, why not make it small and compact, so, without too much trouble, the mill could move it from one job to another if occasion arose? Why not build real controllability into it, especially temperature control and uniformity of temperature? And finally, why couldn't something be done about the expensively large volume of solution it takes to fill the old style boxes?

Williams answered all his own questions in the unit that bears his name. It is versatile, compact, controllable, and requires very little solution.

Possible applications are myriad. One is illustrated in the flowsheet, where two Williams units have been substituted for the two booster boxes. Ranges like this one are for continuous vat dyeing and are quite common. The pad contains reduced color. The booster boxes, or rather, now the Williams units, contain a solution of caustic soda, sodium hydrosulphite, and enough reduced dye to establish color equilibrium between the bath and the fabric. This boosting step is necessary to give the color time to be absorbed and evenly distributed in the fabric. Washing, oxidizing, and soaping are essentially the same as for the pad-steam.

There are two big disadvantages to the system: Deep shades cannot be obtained because the concentration of reduced dye in the padder is limited by its solubility; and second, the very considerable quantity of dye tied up in the old booster boxes made anything but long runs uneconomical. Putting in Williams units doesn't affect the first problem but it helps tremendously on the second. For this and its other virtues the Williams unit

is popular among mill men, although it is seldom recognized by them as a product of chemical engineering.

DYE KETTLE CONTROL

Here is one case, among the five cited here, where the mill itself took the initiative. Procedure on piece dye kettles (see drawing) is to sew the two ends of a piece of goods together, forming an endless loop over the reel, then revolve the reel until the piece reaches the proper depth of shade. Eight or ten pieces are dyed at once. The job in this mill was to dye large yardages to a very close color match from batch to batch.

Existing equipment was archaic. All kettles were open and heated by open steam; on cold days the fog cut visibility to 20 ft. Tubs, reels and baffles were wood. Switching a kettle from a dark color to a light meant boiling out for a day or so, and even then the dark dye was likely to bleed out of the wood into the lighter shade. Temperature control depended on the dyer's hand on a steam valve and the thermometer he waved around in the dye bath. Only one end of the perforated steam pipe was connected to the steam line. It was also up to the operator to add the dyestuff, stir it in behind the baffle to dissolve it, decide when enough had been added, and decide when the goods were the right shade.

The chemical engineer in charge of modernizing the dyehouse knew that modern dye kettles were not the complete answer. To get reproducibility of shade everything had to be the same from one batch to the next and from one end of the kettle to the other. That meant rigid mechanical control.

The new kettles are approximately the same shape as the old, except that they are tightly covered by an insulated hood. They are stainless steel throughout. (Introduction of stainless steel is cited by one machinery builder as the biggest thing that's happened to textile dyeing equipment in 100 years—simply because it doesn't absorb dye the way wood does.) The perforated steam pipe is still there behind the baffle but steam now enters from both ends and the holes are graduated in size to give the same amount of steam, hence the same temperature, the full length of the kettle. Recording and controlling thermometers are at either end of the box. Heating is under completely automatic time-temperature control. For each shade and each quality of goods there is a special cam. It controls steam flow to regulate the complete 1-1½ hr. cycle—so many minutes to heat from room temperature to dyeing temperature, so many at dyeing temperature, so many to dump the dye bath and cool to rinse temperature, and so many minutes in the rinse.

No longer does each dyer make up his own dye bath. Formulas are made up in a central location under the mechanical eye of a spectrophotometer. From the central dissolving tank the dye solution goes to a head tank which feeds to all kettles on the same job. The operator sets a dial to the prescribed amount and the proper volume of solution is automatically passed into the kettle. Nor does the operator have to decide when the proper shade is reached; when the cam-controlled cycle is over the goods come out. The basic concept is that if all the conditions are the same the results will be the same. The chemical engineer's job was to identify the critical conditions and devise a control system that would keep them constant time after time.

That he succeeded is apparent in the drop of re-dye yardage from 15 percent to 3 percent. In addition, less dye is used, steam consumption is down 15 percent because of the hoods; one dyer handles four kettles instead of one; and the boss dyer can see from one end of the house to the other no matter how cold the day.

SOLVENT SCOURING

The problem is to get impurities out of wool cloth. They interfere with dyeing. The impurities are spinning oils put on to assist prior mechanical processes and remnants of tar, paint, creosote or whatever the sheep herder daubed on his animals for identification. Soap and water methods, originally in batch washers and later in continuous ranges, have proved they can handle the spinning oils and general grease and dirt all right, but they have trouble with the tars and paint. Nevertheless soap and detergent washers are universally used because nothing else is available. Solvents are known to be capable of getting out all the impurities but there is no machine available for using solvents. To be practical, such a machine would have to be continuous and would have to recover the solvent.

There's the job. What does chemical engineering have to offer?

One excellent offering, which is creating quite a stir, is shown in the diagram. It is called the Derby continuous dry cleaner after the consultant chemical engineer who developed it. The Riggs and Lombard company has built and installed 20 of them. It does what it was intended to do—continuously remove tars, as well as oils, and recover 96-98 percent of the solvent—and in addition offers a number of extras. Oil can be recovered for reuse; there is no problem of wash water disposal; the soap and detergent bill goes down considerably.

The machine processes up to 30 yd. per min. Cloth enters the bowl between stainless steel fingers and dips into one chamber after another. The solvent, usually tri- or perchlorethylene, cascades from chamber to chamber in the opposite direction.

A vacuum slot removes most of the absorbed solvent; steam heated cans in the drying chamber finish the job. The vacuum slot is a key factor, not so much for its drying qualities, but for the great amount of dirt, chalk and other insolubles that it sucks out with the solvent.

Solvent is recovered from three points—drying chamber, vacuum slot, and the last, or, cloth-entrance, compartment of the bowl. Solvent vapor from the drying chamber is condensed, decanted and returned to storage. Vapor from the vacuum slot goes through the vacuum pump and is partially condensed, the condensate going to the still and the vapor back to the vapor space of the bowl. Dirty liquid solvent from the bowl goes directly to the still. Vapor from the still is condensed, cooled, decanted and returned to storage. Residues, containing the reusable oils, are drawn off intermittently.

•

These five case histories—continuous bleach, pad-steam, Williams unit, kettle control and solvent scouring—don't begin to exhaust the possibilities for showing chemical engineering at work in the textile industry. Through the years an impressive record of accomplishment has been piled up—mostly by outside interests, some by the mills themselves.

They all contribute to the lesson we can learn from the past: that chemical engineering, when given the chance, can do a real job in textiles. The picture today is one of great opportunity, technologically; with few exceptions the mills still depend on their suppliers for the answers to chemical

(Continued on page 134)

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FUTURE

(Continued from page 127)

the industry is on its feet for the first time, really, since chemical engineering came of age. Moreover, it must have learned its lesson from the twenties, for, according to estimates by *Textile World*, it spent $400 million in 1947 on new plants and equipment, which is 4½ times the amount it spent in 1939. If ever, this is the time for chemical engineering to make its bid. But not without caution; let our enterprising chemical engineer keep an eye out for some financial mirages. He'll find no golden opportunity in a marginal mill, flush while the boom lasts and flat when it's over; nor in a newly rich mill, flirting lavishly with science to impress the stockholders but never really intending to marry the girl; nor in a mill where the owners, in spite of the twenties, still figure a fast dollar in the hand is worth two over the long haul.

So much for the factors of size and finances. They are vitally important to the success of a chemical engineer in a textile mill but there is not much he can do about them except look before he leaps. About a third and final factor, however, something can be done. It's a matter of education. The plain truth is, the big majority of textile managers don't know what a chemical engineer is. They know what a chemist it; they know what a mechanical engineer is. But they are not generally familiar with the fact that a special kind of animal has been bred specifically to bridge the gap between these two, and that the name of the species is chemical engineer. It is equally true that chemical engineers rarely, if ever, give a thought to the textile industry as a possible theater of operations. The two groups never got acquainted. During the twenties and thirties the textile industry was preoccupied first with lining its pockets, then with keeping its head above water. In the meantime chemical engineering grew up, found other worlds to conquer, and turned its back on the business of processing textiles. The upshot is that the average mill management has never seen a chemical engineer in action, has no idea what he can do, and consequently feels precious little need of him. It is this unawareness and lack of appreciation that presents by far the biggest obstacle to that enterprising chemical engineer. The sole purpose of this *Chem & Met* report is to make a dent in the barrier by calling attention to some things that textiles and chemical engineering have in common. First we'll pick out the phases of the industry where chemical engineering has the best chance to spread itself. Then, to suggest the sort of thing that can be expected of chemical engineering, we'll cite examples of important things it's already done. Chemical engineers may not be acquainted with the names of these developments but the fundamental problems will be familiar enough. Textile people will know the names all right, but they may be surprised to see them identified as chemical engineering. Perhaps both parties will gain some recognition in the eyes of the other.

For chemical engineering to gain complete recognition by the average mill manager will be no easy matter, but it will have to be so if the chemical engineer is to get anywhere at all. The textile industry is steeped in the tradition of craftsmanship. The master dyer, for instance, is a man of distinction. His art and his little black book rule the dyehouse, and were ruling it long before chemical engineering came along. Management depends on his art and over the years has become conditioned to depend on it. Old John will not be unseated easily, not until management unlearns the habit of generations. That won't come quickly. It is quite the exception today to find a mill manager ready to take the reins away from the tried and true and put chemical engineering in the driver's seat. And unless he is in the driver's seat, our chemical engineer is almost certainly headed straight for frustration. He'll see his every innovation scuttled by the old guard and himself buttoned up in the lab as a routine chemist. Because he is not allowed to do much, he won't be worth much and won't be paid much. (In mills that have shown they know how to use chemical engineers the pay is as good as anywhere.) Eventually he'll get disgusted and go to work for a textile chemicals house, or a dye maker, or the textile division of an equipment company. Maybe he will find consolation in the fact that he is not the first to travel the same road.

Let our enterprising friend beware, then, of half-hearted recognition. He will find golden opportunity only where top management holds his science in greater esteem than Old John's art, and where top management will grant him freedom and authority to pursue his natural function, that of finding and experimenting with better ways to do the job.

PRESENT

(Continued from page 129)

a Monel jig used on direct colors be switched safely to developed colors? Would stainless steel be better?

Would it pay to buy chemicals in larger quantities? Would storage be a problem? How far will it pay to go in mechanical distribution of chemicals to point of use? For instance, instead of carrying soap by bucketful from make-up tank to fulling machines, would it pay to pump it (it's about the consistency of vasoline)? How would you keep it from congealing in the pipes? Would it save money to buy Na_2O_2 and make H_2O_2 out of it by acid treatment? What kickback might that create in the chemistry of the process? How about the mill's making its own bleaching solution from chlorine and caustic solution? Would it have to buy the caustic or could it be recovered from process somewhere?

In the saturators on the continuous bleaching range, could better saturation be obtained by juggling the temperature of the water, amount of wetting agent, agitation, amount of water in the entering cloth? In a six-box washing range, should the sequence of countercurrent water flow be from box number six (cloth entrance box) to five to four to three and out, fresh water going into two then to one (cloth entrance box) and out? Or would some other arrangement—say, six to five and out, four to three and out, two to one and out—do a better job? save water? Suppose three pigments must be present in the ratio of 3:2:1 in the cloth to produce a given shade; should the mix in the pigment padder also be 3:2:1, or will the different dyes go onto the cloth at different rates, and if so what should the bath composition be to make the ratio on the cloth come out 3:2:1? What should the ratio be in the feed to the padder?

PAST

(Continued from page 133)

engineering questions. And yet the future is dubious. In spite of his past performance—in spite of the present need for him within the mills, where he can do the most good—the chemical engineer still faces the task of finding the mill that can support him under management that will accept him.

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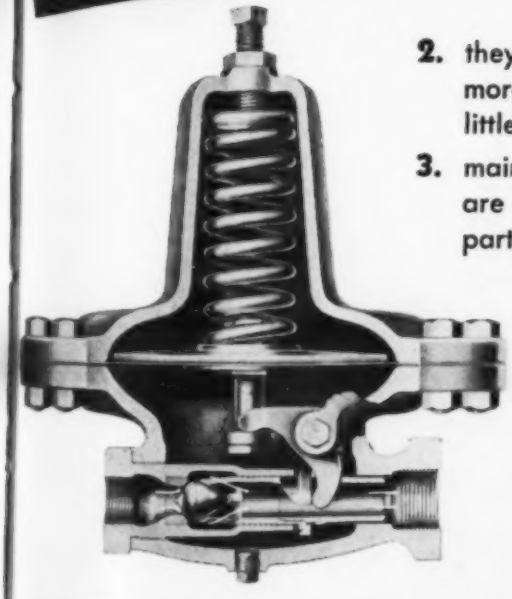

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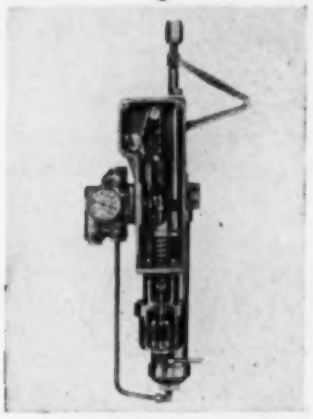

Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

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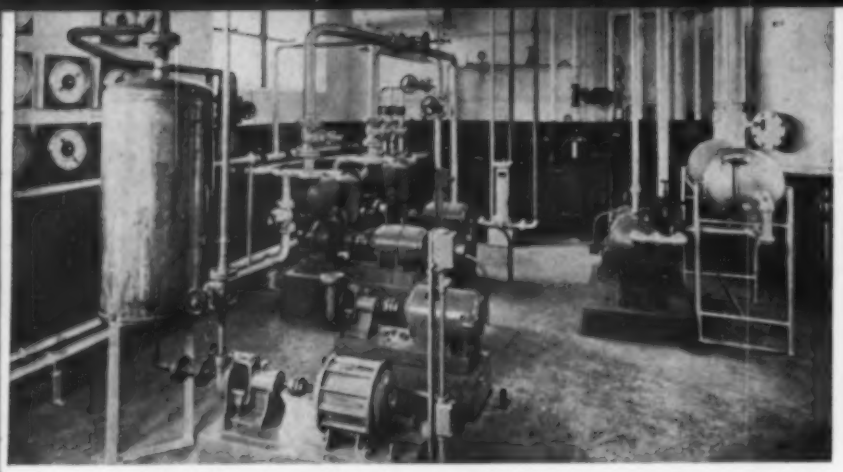

1 Liquid raw materials are pumped from tank cars to storage, then to the process; pumps are operated from either pump-house or plant

2 Salicylic acid is acetylated in stainless steel reactors and the slurry then blown to a suction filter

"Chem & Met"

ASPIRIN

ALL Bayer aspirin is now manufactured in this company's new plant at Trenton, N. J. Completely air conditioned buildings and wide use of stainless steel equipment feature this plant and aid in turning out a product of maximum purity.

Measured quantities of acetic anhydride, salicylic acid and naphtha (a diluent) are charged to the jacketed reactor and heated with hot water. After acetylation the vessel is cooled with cold water and the slurry of aspirin crystals with mother liquor is blown to a suction filter. Mother liquor is drawn off to a vacuum receiver. Crystals in the filter are given a primary benzol wash and are transferred to a wash tank and slurried with benzol. After filtering off the benzol and rewashing, the crystalline aspirin is dried in a tray dryer.

Aspirin crystals are then mixed with pure food starch in a ribbon blender and the mixture ground in an attrition mill. Coarse material is screened out in a bolting reel and reprocessed. The fine powder passes to a tablet machine where it is compressed into 90-grain slugs. These slugs are pulverized and then recompressed in tablet machines which turn out finished 5-grain tablets. Tablets are then inspected and packaged.

Both naphtha and benzol are recovered. Mother liquor is diluted with water and, after standing, separates into two layers. The naphtha-water layer is drawn to a neutralizing tank where caustic soda is added. The neutral salt water is drawn off and discarded and the naphtha is filtered and then purified by distillation. Benzol is recovered in a similar manner.

Quality control is emphasized more than any other single phase of operation. Beginning with the raw materials and intermediates and ending with the finished product, more than 70 control tests assure purity, potency and uniformity. For details see feature story on pp. 98-100.

CHEMICAL ENGINEERING

March 1948

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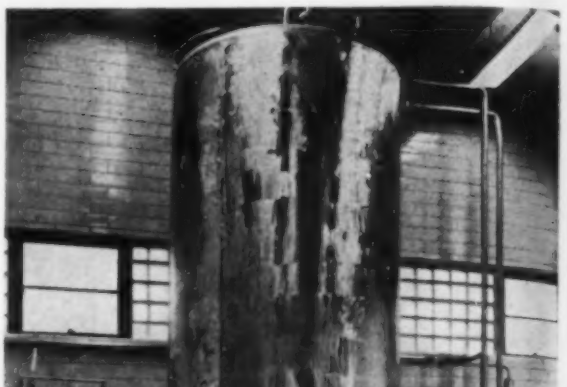
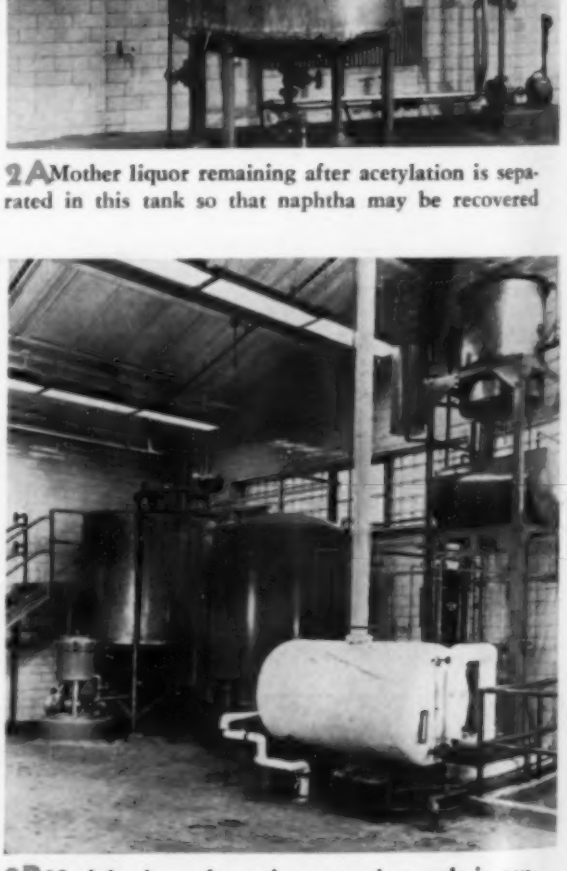


2A Mother liquor remaining after acetylation is separated in this tank so that naphtha may be recovered



2B Naphtha layer from the separating tank is neutralized, filtered, distilled and stored for reuse

PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

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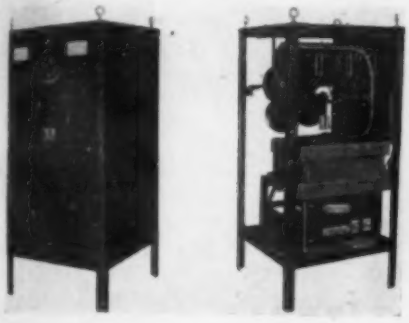
1. Plating Rectifier

A NEW LINE of low-voltage, high-current rectifiers operating on 220 or 440 volt, three-phase a.c. power lines, to deliver d.c. output voltages from zero to 6 volts, with a capacity of 600 amp., is being offered by Mellaphone

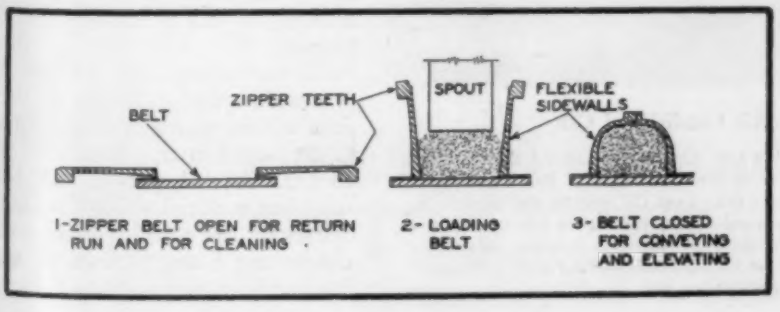


Electronic Rectifier Co., Rochester 2, N. Y. This device employs selenium rectifier elements and a heavy-duty, variable-voltage transformer for stepless voltage control from zero to the maximum setting.

2. Zipper Conveyor

ADAPTATION of the idea of the "zipper" slide fastener to a rubber belt conveyor has been made by Stephens-Adamson Mfg. Co., Aurora, Ill., in a new conveyor elevator appropriately referred to as the Zipper. This device may be likened to a semi-tubular, inclosed belt conveyor which, in a single unit, can travel fully loaded up or down, around corners or in any direction and in any plane. The rubber zipper belt carries its load from feed to discharge within a casing sealed by interlocking zipper fingers and guided through various twists and turns by ball bearing guide rollers. The entire belt itself moves with its load of material from feed hopper to discharge point. The "zipped-up" belt is opened by rollers to discharge the material and the hinged side walls of the casing are spread out flat for passage over pulleys much as an ordinary belt conveyor passes over a head pulley. Other rollers also accomplish belt closure and engagement of the zipper teeth.

This arrangement is said to permit almost any conveying setup desired, for the handling of a wide variety of bulk materials in both granular and small lump form. Since the conveyor operates at comparatively high speeds, large quantities can be handled with a relatively small cross-section belt. The accompanying illustration shows the belt in the open position for the return run and for cleaning; in the loading position; and finally, closed for conveying and elevating.



3. Threadless Fittings

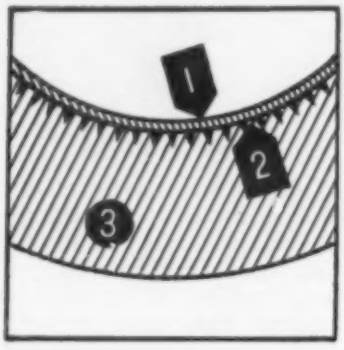
WHAT IS believed to be the first threadless malleable iron fitting line is that introduced by Stanley D. Flagg & Co., 1421 Chestnut St., Philadelphia 2, Pa. These fittings are intended for brazed pipe joints in steel and wrought iron pipelines, enabling this method of pipeline assembly to be applied for the first time to these pipe

materials. Plain-end pipe is used, the elimination of threading permitting pipe of reduced wall thickness and weight to be employed. The fittings are at present made in sizes of 2 in. and under, for 150-lb. working steam pressure at 450 deg. F. or 300 lb. non-shock service at 150 deg. F. A silver brazing alloy which penetrates by capillary action is used, applied with an ordinary brazing torch. No special skill is required. A simple sizing operation is first used on the pipe end, after which the fitting cup and pipe end are fluxed, the pipe inserted and the joint heated until the brazing alloy

melts and flows by capillarity into the joint. An important advantage is space saving as compared with conventional fittings for steel pipe.

4. Improved Bearing

FOR HEAVY-DUTY bearing service, as in the main and connecting rod bearings of heavily loaded diesel engines, the National Bearing Div. of American Brake Shoe Co., St. Louis 10, Mo., has developed a "gridded" bearing, said to combine the favorable features of other bearing designs. As shown in the accompanying illustration, the bearing consists of a centrifugally-cast, lead-bronze shell, designated at "3," formed into a grid on its inner surface, the grid being filled with silver babbitt shown at "2." A



0.002-in. lead-tin alloy "run-in" surface is added at "1." This construction is said to provide the conformability of a strong bronze bearing, plus embedability equal to that of babbitt bearing. It does not require the use of a hardened shaft, and prevents seizure at times of exceptionally

FOR MORE INFORMATION
See Reader Service
Coupon on pages 171–172

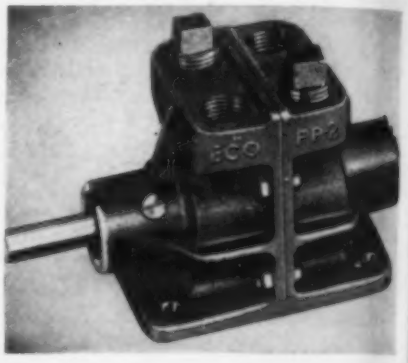
heavy stress. The grid construction supplies the strength lacking in plain babbitt bearings, while the babbitt acts as the actual bearing surface, providing at the same time a safety factor to prevent shaft damage under unusual operating conditions.

5. Power Driver

ENERGY supplied by a small blank cartridge can be used in driving threaded or headed studs into structural steel or concrete by means of the Model B Velocity Power Driver offered by the Mine Safety Appliances Co., Pittsburgh 8, Pa. This enables all manner of attachments to be made rapidly, for mounting pipe hangers, conduit boxes, etc. A 4½ lb. "gun" utilizes the discharge of the cartridge, without flash or recoil, for instantaneous driving of the stud into the concrete or steel. Exceptionally high holding power is claimed for studs so driven. An earlier model was used extensively by the armed forces during World War II.

6. Gearless Pump

EMPLOYING the same general principles involved in the gearless pumps which it has manufactured for the past 12 years for the marine field, the Eco Engineering Co., 12 New York Ave., Newark 1, N. J., has introduced a newly designed line of pumps available in stainless steel, Monel and bronze, primarily for industrial use, in the handling of practically any type of liquid. Among the various improvements made is the use of a new double impeller design, said to give a strong flow against pressure. The pumps are produced in ¼ and ½

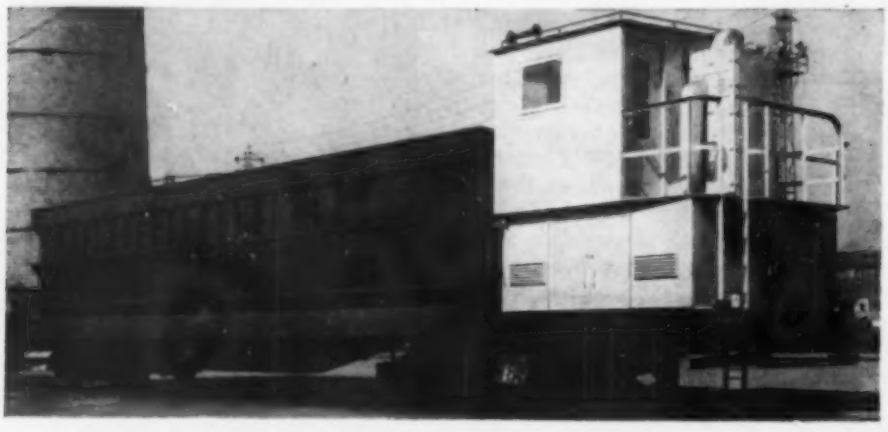


in. sizes, with capacities from 1 to 12 g.p.m., for pressures up to 50 psi. All wearing parts are easily replaced if necessary, and special impellers can be provided to suit the particular characteristic of the liquid being handled.

7. High Vacuum Still

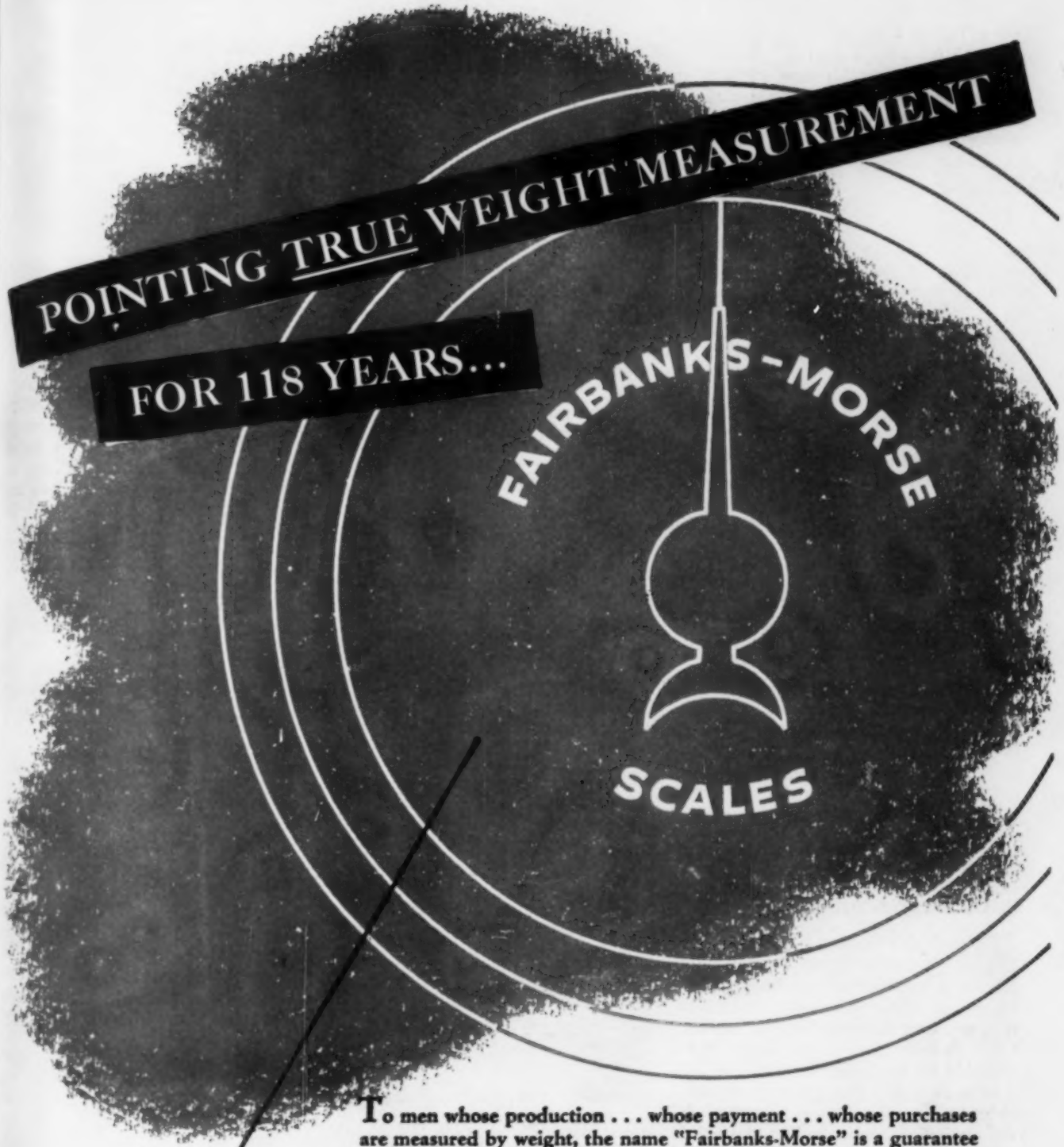
A DEVICE now being built to laboratory size, which is expected eventually to be produced in production size models, is the Bowman high vacuum rotary still now being offered by the Vacuum Engineering Division of National Research Corp., 70 Memorial Drive, Cambridge 42, Mass. Although it operates under the same high vacuum, this still differs from the molecular type in being able to effect separations requiring close fractionation of high-boiling-point liquids. Although it operates differently from conventional fractionating columns, the still, in effect, can be considered as equivalent to a considerable number of theoretical plates in the conventional sense.

Developed for Gulf Research & Development Co. by John R. Bowman at Mellon Institute of Industrial Research, the still is licensed for manufacture, and sub-licensing, through National Research. It consists of an evacuated cylinder, heated on the outside, within which is a concentric rotating condenser, internally water cooled. A still pot at the bottom vaporizes material which rises and condenses on the rotating condenser, the condensate being thrown off centrifugally for re-evaporation on the inner



De Luxe Quenching Car with Air Conditioned Cab

This coke quenching car, which is provided with an air conditioned cab for the comfort of the operator, has recently been put into operation at the coke works of Bethlehem Steel Co., Bethlehem, Pa. The car carries the incandescent coke from the oven to the quenching tower where it is deluged with water. It is constructed almost entirely of Mayari R low-alloy, high-strength steel to resist the high temperature and severely corrosive conditions encountered. The insulated operator's cab is kept at constant temperature with a thermostatically controlled air conditioning unit.



When it comes to scales...

To men whose production . . . whose payment . . . whose purchases are measured by weight, the name "Fairbanks-Morse" is a guarantee of unfailing accuracy.

Modern Fairbanks-Morse Scales have added the advantages of automatic weighing and push-button recording to almost every conceivable weighing operation — including, no doubt, some similar to yours.

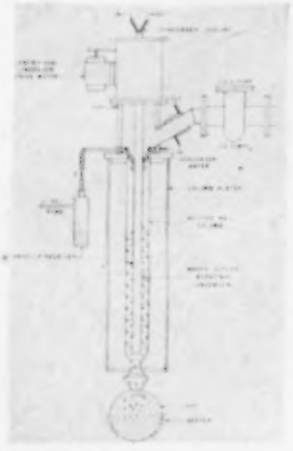
Ask a Fairbanks-Morse engineer about the latest developments in weighing instruments for *your* job at hand.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • STOKERS • SCALES • MOTORS • GENERATORS • PUMPS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

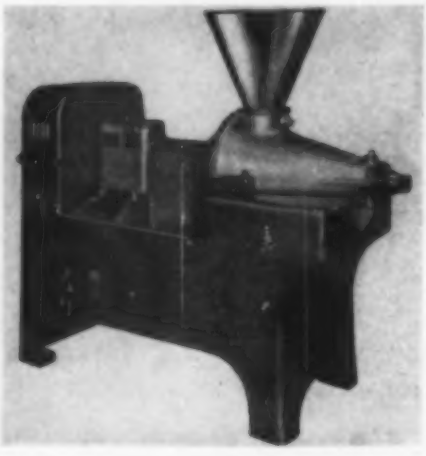
wall of the heated cylinder. Liquid striking the evaporator wall partially re-evaporates as it flows downward, and the re-evaporated material is re-condensed and again thrown off centrifugally.



The effect is that the vapor stream is continually enriched by removal of high-boiling material and by the addition of lower-boiling material by the evaporator. The reflux ratio can readily be controlled by regulating the portion of condensate returned to the still for revaporization. Since all of the usual sources of pressure drop in fractionating columns are largely eliminated, extremely low pressures can be used and fractionations can be accomplished which have previously been impossible.

8. Continuous Mixer

CONTINUOUS mixing work on mixtures ranging up to the consistency and density of bread dough can be handled by means of the new Roto-Feed continuous mixer developed by the Marco Co., Wilmington, Del. Sizes are available for capacities from as low as 5 to as high as 1,000 g.p.h. It is said only to be necessary to proportion the desired ingredients into the machine which then discharges them continuously in a thoroughly mixed condition. Although it is not designed to handle dry materials alone, it is said to be capable of processing most mixtures encountered in the process field. The machine is a unit, including a heavy base on which the mixer proper is mounted, together with the speed reduction and driving equipment. The mixer proper is a conical chamber within which is a specially designed agitating device that not only exerts a strong mixing action, but also forces the mixed materials from the discharge. The mixer proper is constructed of stainless steel, with the base and inclosures fabricated largely from sheet and cast aluminum.

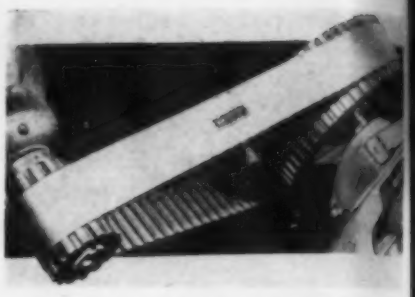


9. Compact Fork Truck

FOLLOWING four years of development work, the Type FQH-10 center-control fork truck now offered by the Baker-Raulang Co., 2168 West 25th St., Cleveland 13, Ohio, is intended for applications requiring a light-weight truck of 1,000 lb. capacity. It is said to be particularly useful in plants having narrow aisles, congested areas, limited floor capacity, and small and low-capacity elevators. Having a wheelbase of 36 in., the truck requires only 67½ in. plus the length of the load to make a right-angle turn. The width is only 28 in. Despite its small dimensions, however, the truck is said to be exceptionally stable. It is of the all-electric type with three speeds forward and reverse. Low first cost is an important feature.

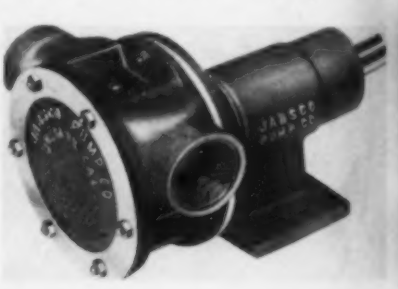
10. Toothed Belt

RUBBER TEETH which, working on special grooved pulleys, are said completely to eliminate slippage, are a feature of a new belt produced by the L. H. Gilmer Div. of United States Rubber Co., Rockefeller Center, New York, N. Y. The belt is reinforced with steel cables imbedded in oil-resisting synthetic rubber. The cables are said to reduce stretch almost to zero, eliminating need for take-up devices. In operation the belt makes positive engagement with the pulleys at any speed ranging from a minimum to 10,000 ft. per min. Its use is particularly indicated where extreme accuracy of relation between driving and driven pulleys is necessary.



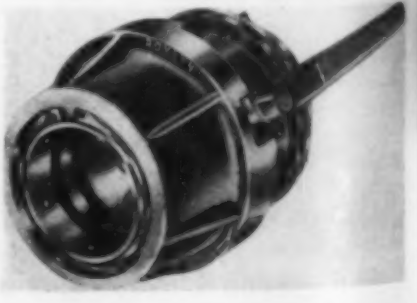
11. Rotary Pump

TYPE 317 stainless steel is used in the construction of a new rotary pump offered for chemical industry use by Jabsco Pump Co., 2031 North Lincoln St., Burbank, Calif. The pump is self-priming, making use of a flexible neoprene impeller which serves both to move the liquid and to seal the suction from the discharge pipe.



12. Trip-Proof Coupling

A COMBINATION of shut-off valve and quick coupling is incorporated in the new Tri-Proof coupling offered by Roylyn, Inc., 718 West Wilson Ave., Glendale 3, Calif. A valve lever is meshed with the locking collar of the coupling. The valve must be in the shut-off position before the coup-



Our customers want, and need, more tank cars because of increased volume . . . expanded and newly acquired plants. General American has built plants . . . stepped up manufacturing facilities . . . and will keep on expanding to meet the growing transportation needs of our customers. Right now we are building as many cars as the supply of materials will permit. As more materials are made available, we will continue to increase the GATX fleet so that our customers can have sufficient economical transportation for all bulk liquids.

GATX GENERAL AMERICAN TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street, Chicago
DISTRICT OFFICES: Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans
New York • Pittsburgh • St. Louis • San Francisco • Seattle • Tulsa • Washington
EXPORT DEPT., 10 East 49th Street, New York 17, New York

● TANKS— ● FLOORS— ● STACKS—

. . . AND OTHER EQUIPMENT SUBJECT TO CORROSIVE ATTACK, NEED NOT BE CONSTANT SOURCES OF TROUBLE AND MAINTENANCE EXPENSE.

Rubber-lined steel and Atlas brick and Tegul-VITROBOND linings like these — in service for nine years and more, are doing yeoman work in chemical service handling sulphuric and phosphoric acids.*

This floor of Atlas brick and ALKOR has withstood years of service under attack of organic solvents, greases, inorganic acids and alkalis, without a stop for maintenance, repairs or replacement.*

Acid-proof stack lined with brick, joined with Atlas VITREX. VITREX is unaffected by temperatures up to 1600° F. regardless of acid concentration. VITREX finds wide use in acid towers, fume ducts, stacks, acid evaporators and tanks.

With Atlas Construction you can dismiss concern about attacks by acids, alkalis, solvents, fats and oils, water, steam and high temperatures.

There is no guesswork about Atlas Construction. It's proof against, not merely *resistant* to these elements. It is used by leaders in chemical, steel and other industries where corrosives can present a maintenance problem. Atlas Construction serves year after year without "down time" for maintenance.

Atlas design includes such important and exclusive developments as Dual Construction (patented) which not only reduces labor costs but elevates temperature at which equipment may be operated.

Atlas can furnish equipment that will solve your corrosion problem. Our engineers will gladly make recommendations and supply plans and estimates, without obligation.

Contact our nearest branch—and write us at Mertztown for Bulletin No. T3-B.

*Tegul-VITROBOND is a plasticized sulphur cement.

ALKOR is a synthetic resin, the *original* alkali- and acid-proof cement.

ATLAS RENDERS A *COMPLETE* SERVICE

Plans and special designs.
Materials: acid-proof cements, plastic linings, jointing material and protective coatings.
Installation too, if desired.

THE Atlas Mineral PRODUCTS COMPANY OF PENNA.

MERTZTOWN, PENNSYLVANIA

*ATLANTA 3, Ga., 452 Spring St., N. W.
*CHICAGO 1, Ill., 333 No. Michigan Ave.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.
PITTSBURGH 27, Pa., 4921 Plymouth Rd.
PHILADELPHIA, Pa., 333 Fairview Rd. Springfield, Pa.
ST. LOUIS 8, Mo., 4483 Olive St.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

*BERKELEY 2, Calif., 605 Addison St.
DALLAS 5, Tex., 3921 Purdue St.
*DENVER 2, Colo., 1921 Blake St.
*HONOLULU 2, Hawaii, U.S.A., P.O. Box 2930
OMAHA, Neb., 423 South 38th Ave.
*LOS ANGELES 12, Cal., 172 S. Central Ave.
NEW ORLEANS 12, La., 208 Vincent Bldg.
*SEATTLE 4, Wash., 1252 First Avenue, S.
*Stock carried at these points

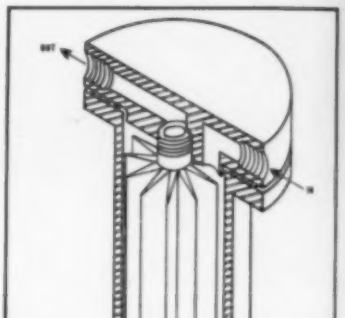
IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

ling can be broken, and conversely, the coupling must be locked in its mating nipple before the valve can be opened. The piston-type valve is said to effect a seal even with static pressure. Available at present in the 2½ in. pipe size, larger units are contemplated for later production. The coupling itself can be opened by means of a 40 deg. rotation and is said to be easily operated and positive, and to require no tools.

13. In-Line Filter

CONTINUING development of its various types of porous stainless steel filter elements, Micro-Metallic Corp., 193 Bradford St., Brooklyn 7, N. Y., has announced a pipeline type filter



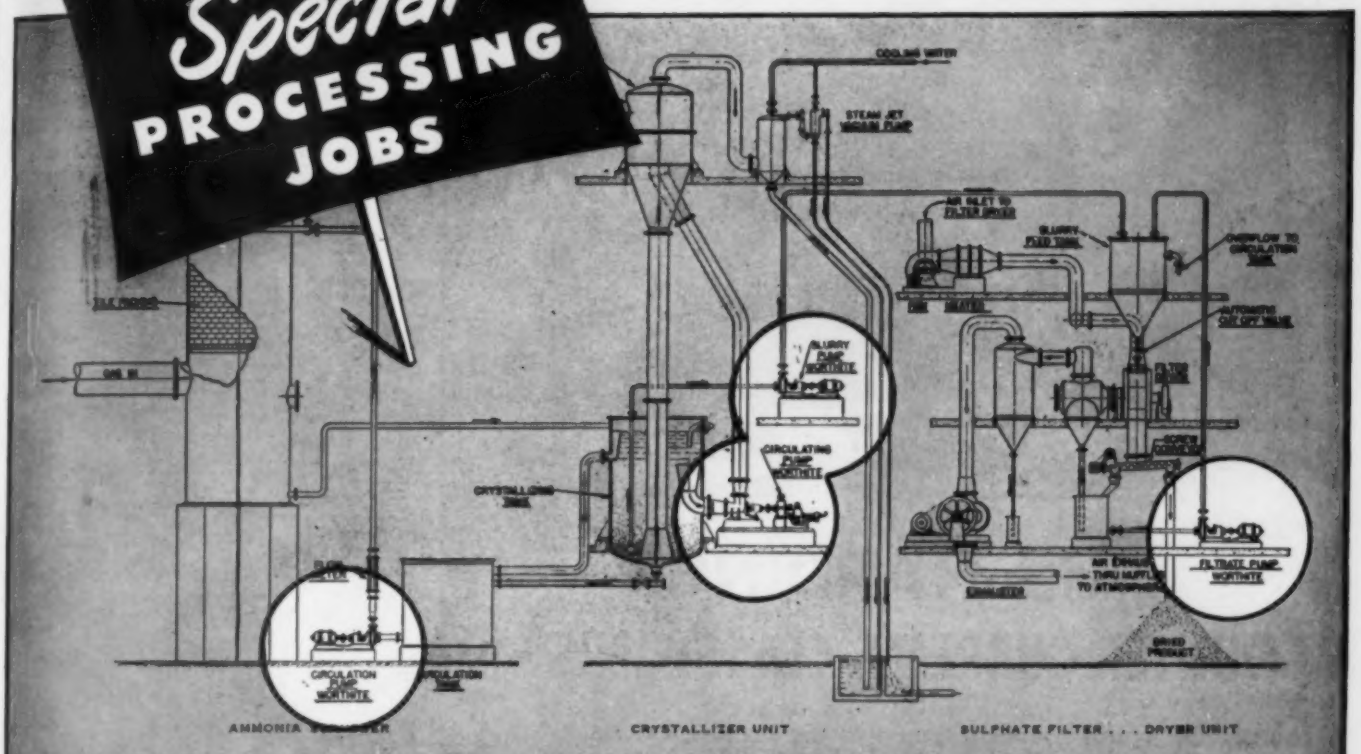
fabricated from porous stainless steel sheets welded into an assembly of star-shaped cross section to give large filter area within a small volume. Filter bodies are available for pressure up to 200 psi., but units rated for higher pressures can be secured. The company is also producing bayonet and cylindrical type filtering elements of porous stainless.

14. Electronic pH Meter

LINE OPERATION is an important characteristic of a new electronic pH meter offered by Photovolt Corp., 95 Madison Ave., New York 16, N. Y. The instrument covers the entire pH range and is provided with a temperature compensation, adjustable for the full range from 0 to 100 deg. C. The instrument employs a glass electrode, uses no batteries whatever, and is automatically stabilized against line

FOR YOUR *Special* PROCESSING JOBS

Investigate these Standard pumps in super-stainless Worthite



A Typical Ammonium Sulfate Crystal Process Showing Worthite Pumps in Key Positions

Worthington Worthite Pumps have solved many problems involving corrosive or corrosive-abrasive liquids. For example:

In this modern ammonium sulfate crystallizer process, standard Worthington Worthite Pumps are used. At one point, a Worthite Pump handles crystals with negligible breakage — an important advantage, since unbroken crystals, being uniform and dustless, are superior to saturator-produced crystals and competitive with the best synthetic or imported product.

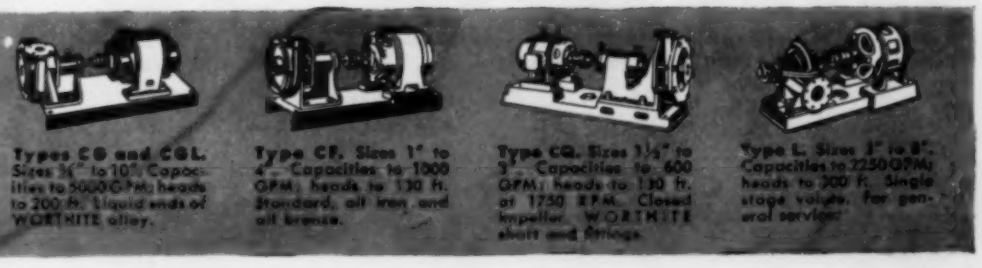
Here's an instance where Worthite Pumps benefit product *quality!* In addition, their high resistance to corrosion and abrasion makes them ideal for handling a wide range of acids, alkalis and salts — clear liquids or slurries — efficiently and economically.

Look Into This Improved Stainless Steel

Learn more about Worthite — a high-nickel, high-chromium, low-carbon molybdenum alloy steel. For facts that prove *there's more worth in Worthington*, call our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

WORTHINGTON

THE WORLD'S LARGEST MANUFACTURER OF PUMPS



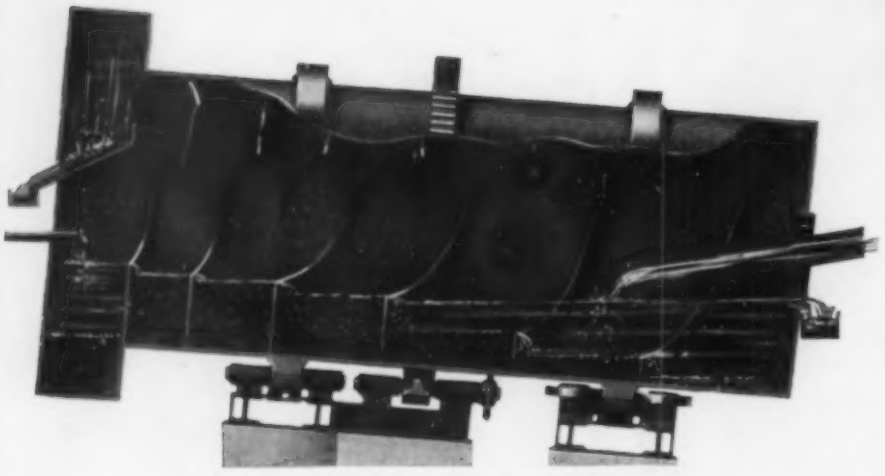
Types CG and CGL. Sizes 3/4" to 10". Capacities to 5000 GPM; heads to 200 ft. Liquid ends of WORTHITE alloy.

Type CF. Sizes 1" to 4". Capacities to 1000 GPM; heads to 130 ft. Standard, all iron and all bronze.

Type CQ. Sizes 1½" to 3". Capacities to 600 GPM; heads to 130 ft. at 1750 RPM. Closed impeller. WORTHITE shaft and fittings.

Type L. Sizes 3" to 8". Capacities to 2250 GPM; heads to 300 ft. Single stage volute, for general service.

Better Separation– Cleaner Sands

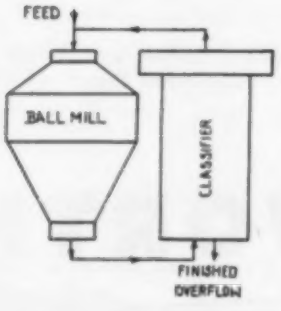


. . . with HARDINGE COUNTER-CURRENT CLASSIFIERS

The unique "spiral squeeze" action of the Hardinge Counter-Current Classifier literally wrings the fines from the sands—producing a cleaner, more uniform oversize, nearly dry if desired. The mixture to be separated is fed into the lower end of the classifier, which is inclined to the horizontal and rotates slowly. The coarser particles settle out and are picked up by the classifier spirals, agitated, washed, squeezed and discharged by lifting flights at the higher end. The fines are discharged with the wash water at the lower end.

MILL AND CLASSIFIER IN CLOSED CIRCUIT

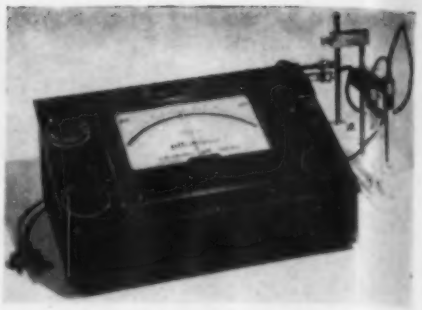
Highly efficient when used in closed circuit wet grinding with a mill (see diagram), this classifier returns the oversize to the mill for further grinding and discharges a product as fine as —200 mesh, if desired.



Write for Bulletin 39-A.

HARDINGE
COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1



voltage fluctuations. In addition to its main purpose, the instrument may also be used for electrical titration and as a high-resistance millovolt meter.

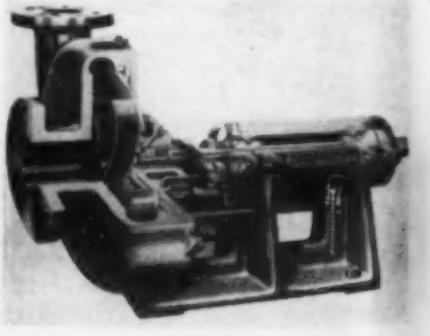
15. Power Wheelbarrow

LOADS UP TO 2,000 lb., or 12 cu. ft., can be handled at speeds up to 15 m.p.h. with the new Whiteman Power Buggy manufactured by Whiteman Mfg. Co., Los Angeles 26, Calif. This device, a motorized wheelbarrow

which carries its operator and employs a 6 h.p. motor, can handle practically any solid or semi-solid. As the illustration shows, the machine incorporates a 12-cu. ft. dumping hopper and is narrow enough to go through doors and narrow passages. With single wheels it is only 28 in. wide, and with dual wheels, 36 in. wide. It can turn in its own radius, weighs only 750 lb., and is able to go up a 25-deg. ramp with its load.

16. Novel Pump

ORIGINALLY developed by the Sherzer Pump Co. is a novel centrifugal type which is now being put on the general market for the first time by



tantalum

Chemical Processing Equipment

TRUE ECONOMY

from every angle

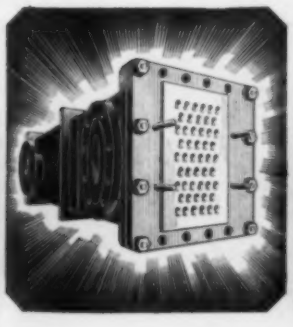
Tantalum condensers are noted for high efficiency in small space. One square foot of tantalum often transfers as much heat as 18 to 20 square feet of non-metallic area.

The outstanding economy of Tantalum acid-proof equipment is in its complete freedom from corrosion and contamination, its remarkably high efficiency in heat transfer operations, its long life in continuous service with freedom from shutdowns, interruptions, replacements and repairs.

Tantalum heaters, coolers, condensers, evaporators, HCl plants and distillation and recovery units have proved their economy throughout the world. Initial costs are not as high as you might think, overall costs are suprisingly low, consult on your corrosion problems with Fansteel Metallurgical Corporation, North Chicago, Illinois.

USE TANTALUM WITH ECONOMY

For most acid solutions and corrosive gases or vapors, except HF, alkalis, or substances containing free SO_3



Fansteel

Acid-Proof

TANTALUM

CHEMICAL PLANT EQUIPMENT

Tee up with this fitting

...make a drive on replacement costs with acid-and corrosion-resistant Ampco Aluminum Bronzes—ideal for petroleum and other process industries

Here's a tee that takes lots of punishment. First of all, it is made from Ampco aluminum bronze, long a favorite of process industries because of its acid- and corrosion-resistant properties and longer life. Secondly, this tee is drop-forged — it has a density and perfection not found in other process-service fittings.

Ampco aluminum bronzes are used by petroleum and other process industries throughout the country for more than just fittings. Conveyors, pickling vats, pickling forks, venturi tubes, condensers, and many other items used in processing corrosive substances are fabricated from this long-life, money-saving metal. Available in a wide variety of forms such as castings, extruded products, weldrod, etc.; also complete facilities for fabricating. Call in an Ampco field engineer and let him show you why equipment made from Ampco aluminum bronze gives longer life and lower costs. Write us for literature.

AMPCO METAL, INC.

Department CE-3 Milwaukee 4, Wisconsin

AMPCO TRADE MARK REG. U. S. PAT. OFF.

P-19

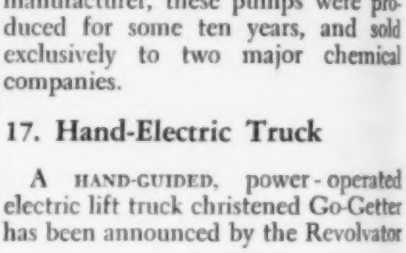
Field Offices in Principal Cities

FOR MORE INFORMATION
See Reader Service Coupon on pages 159-160

the Mission Manufacturing Co., Houston, Texas. One of the novel features of the new pump is the fact that it employs a concentric casing to reduce turbulence and cavitation. The pump is a single-stage, end-suction type with large non-clogging fluid passages to permit the handling of slurries containing solids and materials in suspension. Only four easily removable parts, the casing, impeller, wearplate and shaft, are in contact with the fluid pumped, and these may be furnished in any workable alloy. A change in capacity or head requirements within a wide range can easily be accomplished by a simple change of impeller diameter, or of casing and impeller size. Under the original manufacturer, these pumps were produced for some ten years, and sold exclusively to two major chemical companies.

17. Hand-Electric Truck

A HAND-GUIDED, power-operated electric lift truck christened Go-Getter has been announced by the Revolvator



Co., North Bergen, N. J. Capacities of 4,000 and 6,000 lb. are available, with lift heights of 7, 9 and 11 in., and lengths from 36 to 72 in., and over. A similar design will be available in pallet and high-lift types.

18. Tank Trailer

To PROVIDE portability in intra-plant service for tanks containing

Armour Presents

THREE NEW GROUPS OF CHEMICALS WITH

a challenge to the chemical world

New chemicals are always a challenge to the industrial chemist — a stimulating challenge to examine, to modify — and, finally, to adapt.

Particularly challenging are the three new chemical groups Armour now presents for your investigation: the Ethomeens, the Ethomids, and the Ethofats. So far, these cationic and non-ionic chemicals have proven themselves particularly valuable as wetting agents, detergents, emulsifiers (and emulsion-breakers), and as chemical intermediates. But very frankly, Armour feels that these uses merely skim the surface of their industrial possibilities — especially considering that some forty basic products (each in a wide range of solubilities) can be produced in commercial quantities.

A booklet on the Ethomeens, Ethomids and Ethofats is available upon request. It describes the general characteristics and properties of these surface-active chemicals, plus their known and indicated uses. Also included is a complete product listing from which samples may be requested for laboratory testing. ACCEPT THE CHALLENGE TODAY!

Presenting the Ethomeens!

The Ethomeens, a series of related chemicals made from the Armeens (Armour's fatty amines) are cationic in character and can be made with varying degrees of cationic tendencies. The Ethomeens are stable to hydrolysis in all concentrations of acids and bases. Indicated uses: as germicides, as wetting agents, as detergents in acid solutions, as waxes, as emulsifiers.

Presenting the Ethomids!

The Ethomids are a group of chemicals made from the Armids (Armour's fatty amides) and, being non-ionic in character, are compatible with anionic, cationic and non-ionic surface active materials. The Ethomids tend to be more stable to hydrolysis than the Ethofats in medium concentrations of acids and bases. Indicated uses: as detergents, as emulsifying agents, as wetting agents, as waxes, as dispersing agents.

Presenting the Ethofats!

The Ethofats are chemicals prepared from the Neo-Fats (Armour's fatty acids) and are also non-ionic in character. They are stable in mild acids and bases. The Ethofats are excellent non-sudsing detergents (even for cottons) and can be built with alkaline salts. Other indicated uses: as emulsifiers, as stabilizers in the compounding of natural and synthetic latex, as wetting agents, as detergents in dry cleaning solutions.

MAIL THIS COUPON TODAY!

(Attach to your business letterhead, please)

ARMOUR CHEMICAL DIVISION
1355 West 31st Street — Chicago 9, Illinois

Please send me the new booklet on
The Ethomeens, Ethomids and Ethofats

Name.....*Title*.....

Firm.....

Address.....

City.....*Zone*.....*State*.....

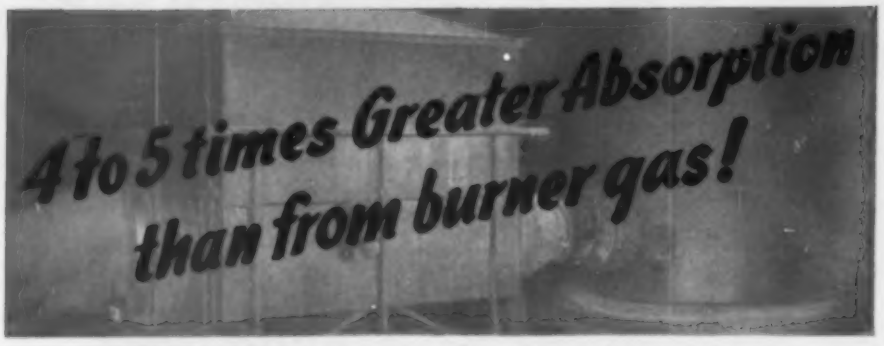
ARMOUR Chemical DIVISION

1355 West 31st Street
Chicago 9, Illinois

GET *maximum absorption*

OF SULFUR DIOXIDE IN WATER WITH

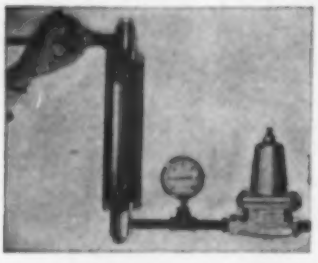
ANSUL SO_2



EQUILIBRIUM SOLUBILITY OF SO_2 IN WATER AT ONE ATMOSPHERE (Saturated Solution)

Temp. F.	% SO_2 by Weight in Solution			
	From Ansul Liquid SO_2	From Burner Gas Containing:		
		20% SO_2	18% SO_2	16% SO_2
32	18.59%	4.61%	4.15%	3.68%
50.6	13.95%	3.25%	2.93%	2.60%
68	10.14%	2.27%	2.02%	1.82%
77	8.60%	1.89%	1.70%	1.51%
86	7.30%	1.58%	1.42%	1.26%

It's So Easy to Install This Ansul SO_2 System and Get These Proved Advantages:



GREATER SOLUBILITY—As indicated in the table, much more concentrated water solutions of SO_2 may be obtained from 99.9+% Ansul Liquid SO_2 than from the most efficiently produced burner gas.*

HIGHER PURITY—Elimination of impurities inherent in burner gas (Ansul Liquid SO_2 is 99.9+% [by weight] PURE).

FINGER-TIP CONTROL—Easy, positive, finger-tip control providing extreme accuracy for reaction or adjustment of pH.

GREATER ECONOMY—Small investment in equipment, materially reduced operating and maintenance costs, and freeing of valuable floor space.

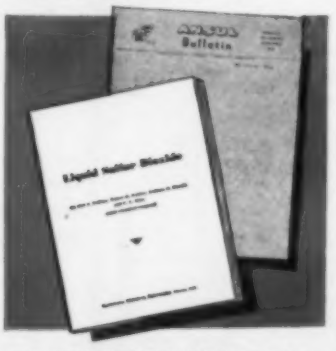
*This follows the principle described in Henry's law that the concentration of a dissolved gas in solution is in direct proportion to the concentration in the free space above the liquid.

WRITE THE ANSUL TECHNICAL STAFF FOR FURTHER INFORMATION

Liquid Sulfur Dioxide by ANSUL

PHYSICAL PROPERTIES

Chemical formula	SO_2
Molecular weight	64.06
Color (gas and liquid)	Colorless
Odor	Characteristic, pungent
Melting point	−103.9° F. (−75.5° C.)
Boiling point	14.0° F. (−10.0° C.)
Density of liquid at 80° F.	(85.03 lbs. per cu. ft.)
Specific gravity at 80° F.	1.363
Density of gas at 0° C. and 760 mm.	2.9267 grams per liter (0.1827 lb. per cu. ft.)
Critical temperature	314.82° F. (157.12° C.)
Critical pressure	1141.5 lbs. per sq. in. abs.
Solubility	Soluble in water
Purity	99.9+% (by wt.) SO_2 (H_2O less than 0.01%)

*REG. U. S. PAT. OFF.

Send for Bulletin 020.1, "A Comparison of Ansul SO_2 and Sulfur Burner Gas," and also for your copy of "Liquid Sulfur Dioxide"—a treatise on the properties, characteristics, and industrial uses of Liquid Sulfur Dioxide—written by the Ansul Technical Staff. *WRITE Dept. C.*

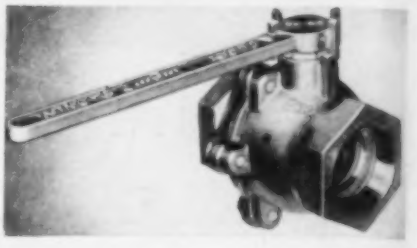
Also Manufacturers of Methyl Chloride

ANSUL CHEMICAL COMPANY
INDUSTRIAL CHEMICALS DIVISION, MARINETTE, WIS.
60 E. 42nd St., New York — 535 Chestnut St., Philadelphia

liquid materials, Easton Car & Construction Co., Easton, Pa., has developed the Model TT tank trailer shown in an accompanying view. The trailer illustrated is one of a fleet designed to move 1,250-gal. storage tanks within the plant area of a large chemical manufacturing company. The unit is of all-welded construction, employs pneumatic tires and supports the tank in three cradles. Steel straps holding the tank in place may be disconnected readily for removal or replacement of the tank.

19. Ball Type Valve

A FULL-ROUND opening, which is claimed to produce no turbulence in the fluid stream, is the feature of the new ball type valve introduced by Rockwood Sprinkler Co., Worcester 5, Mass. The valve element is a floating bronze ball containing a flow passage, which seats against a synthetic rubber seat. This feature is said to wipe abrasive particles automatically from the seating surface. When the valve is in the closed position, the pressure of the fluid automatically positions the ball against the synthetic rubber seat to form a tight seal. The valve comes in sizes from ¼ to 2 in., for 150 psi. working pressure and for handling a variety of liquids and gases.



Equipment Briefs

20. SONIC means are being employed in determination of the elastic properties of fibers, yarns, fabrics, plastics, paper and similar materials in an instrument known as the Pulse Propagation Meter, which is being offered by Fabric Research Laboratories, 665 Boylston St., Boston, Mass. The instrument was developed in cooperation with the Magnetic Amplifier Corp., 4 Gordon St., Waltham, Mass., who produce and sell the instrument. The instrument is entirely automatic and uses the pulse technique for the first time in this field in determining the velocity of sound and therefore the elastic modulus of the material.

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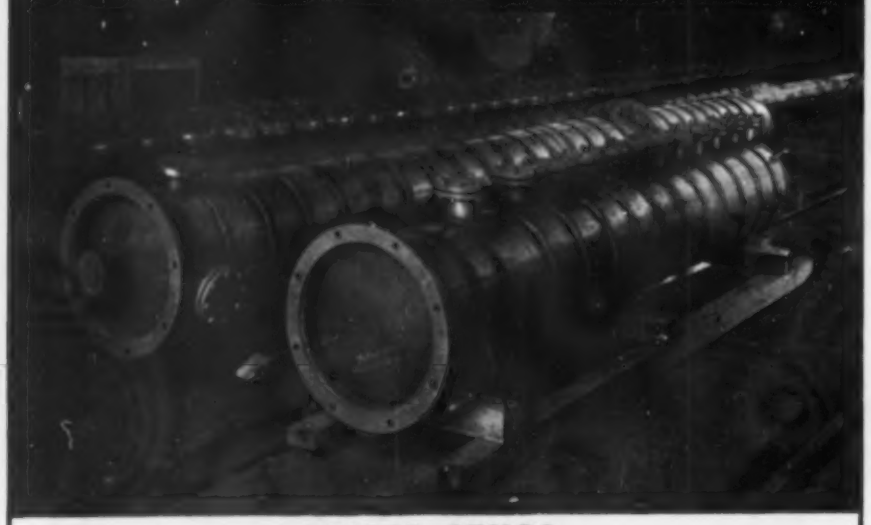

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FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

Todd Shipyards Corp., 81-16 45th Ave., Elmhurst, L. I., N. Y., has developed a heated air generator producing homogeneous hot air of controllable velocity, temperature, quantity and pressure. The machine is produced in two sizes, 1,000 c.f.m. and 10,000 c.f.m., at 350 deg. F.

22. A NEW LINE of flexible tubings in all sizes up to 3 in. in diameter, for services requiring unusual alkali, acid and chemical resistance, as well as resistance to high pressure and high temperature, is being offered by the Irvington Varnish & Insulator Co., 6 Argyle Terrace, Irvington 11, N. J. The tubings are available in a complete range of colors, as well as in clear plastic.

23. SARAN-LINED pipe, which was announced recently by Dow Chemical Co., Midland, Mich., and described in our November 1947 issue, is now being distributed exclusively by the Saran Lined Pipe Co., Stephenson Building, Detroit, Mich. This does not, however, alter the original arrangement where the pipe and fittings are produced at Dow's Midland plant.

24. A NEW low-cost nitrogen generator, said to be able to produce nitrogen at a few cents per thousand cubic feet from air and any suitable fuel gas, has been announced by Gas Atmospheres, Inc., 20011 West Lake Road, Cleveland 16, Ohio. As ordinarily furnished, the unit produces nitrogen up to 99 percent pure although with suitable auxiliaries, 100 percent nitrogen can be produced. The machine uses monoethanolamine for carbon dioxide removal and activated alumina for water removal.

25. A NEW development in metal-spray guns in which the wire feed is accomplished by means of a small constant-speed induction motor, rather than by a turbine drive operating on the gas supplied to the gun, has been announced by the Metallizing Co. of America, 1330 West Congress St., Chicago 7, Ill. This gun is said to be particularly suitable for production-line metal spraying or other types of spraying where top speeds are essential. The motorized drive is claimed to insure correct feed under all conditions.

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

51. Improved GR-S

AN IMPROVED synthetic GR-S type rubber has been developed by the United States Rubber Co., Rockefeller Center, New York, N. Y. This improved product resembles natural rubber more closely than the ordinary GR-S, and results from processing the latex at temperatures as low as 0 deg. F., instead of the 125 deg. F., commonly used. The new rubber is said to equal natural rubber in tensile strength and elongation, while it is expected to be superior to natural rubber in cracking resistance and abrasion resistance. The United States Rubber Co. is equipping part of the plant it operates at Borger, Tex., to produce GR-S at this low temperature. No basic change in the plant is required to change over, and it is anticipated that rubber production at the new low temperature will be approximately the same as by the present process.

One of the obstacles which has been overcome in this work is the development of compounds which accelerate the reaction. These materials are cumene hydroperoxide, an oxidizing agent; invert sugar, a reducing agent; sodium pyrophosphate, and ferrous sulphate, activating agents. These offset the normal slowing down of reaction which occurs when temperatures are lowered. With the new process it is necessary to add an anti-freeze to the mixture to prevent the water in the mixture from freezing.

52. Sodium Phospho Aluminate

DEVELOPED to serve as an adjunct to papermaker's alum, sodium phospho aluminate is now available from the American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y. This new type of alum contains a double salt of sodium aluminate and sodium orthophosphate, containing approximately 70 percent of sodium aluminate and 20 percent of sodium orthophosphate. This new material is a white powder soluble in water and is an alkaline source of alum as opposed to common alum which has an acid reaction. The reaction between sodium phospho aluminate and alum induces coprecipitation of aluminum hydroxide and aluminum phosphate which can thus be introduced over a wide range of alkalinity or acidity. With this new material it is possible to introduce any quantity of alum in the paper stock without unduly increasing the acidity.

One of the advantages of sodium phospho aluminate is that it does not hydrolize as readily as alum. A 2 to 3 percent solution remains stable for a period of several hours, and when hydrolysis takes place both aluminum hydroxide and aluminum phosphate precipitate in the form of fluffy particles which do not coat the walls of the tanks nor clog pipelines.

The use of this new material is said to have the following advantages: (1) A higher pH at the head box, which is instrumental in yielding a paper of lower acidity and longer life. (2) A higher pH of the stock which prevents or alleviates corrosion of wire and equipment. (3) Increased retention of filler and fiber. (4) More uniform and better sizing. (5) In combination with alum, it supplies any desired amount of alumina at a minimum build up of sulphate ions in white water. In addition sodium phosphor aluminate is claimed to be particularly useful in the manufacture of wet strength papers. Other uses suggested include the following: As a boiler feedwater treatment compound for softening and coagulating; for floculation and removal of impurities in water treating plants.

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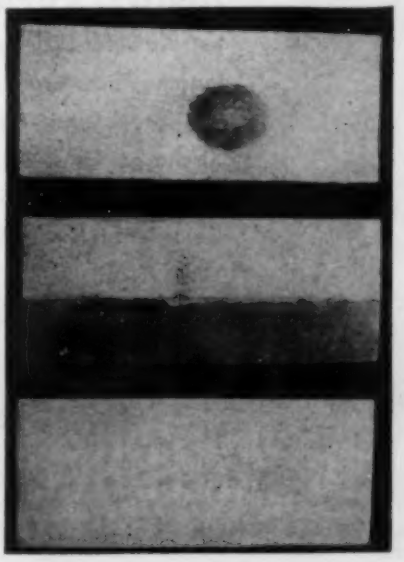
FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

53. Knot Sealer

BY USE of a new knot sealing compound, it is now possible to upgrade knotty lumber so that it may be used on exterior siding. This new compound is a formulation of Bakelite and vinylite plastics, and will satisfactorily seal knots so that they will not require frequent repainting.

Consisting of vinyl butyral resin dissolved in alcohol, to which is added a Bakelite phenolic resin, this material is claimed to out-perform other compounds used for this purpose. It is applied by brushing over unprimed knots and the surrounding area. The coats of paint are then applied in the usual manner.

An unsealed knot will soon become



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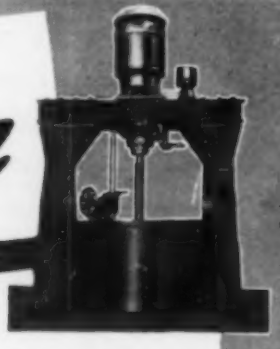

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visible and cause the paint covering it to deteriorate, as shown in the top panel of the illustration. The knot in the center panel has been sealed with this new formulation and shows how the paint covers it. The panel at the bottom shows no indication of the sealed knot that is underneath. The paint film that covers the knot will last as long as that which covers the clear portion of the wood.

54. Silicone Treated Paper

NOW AVAILABLE in commercial quantities from the Dow Chemical Co., Midland, Mich., is a silicone treated tissue paper for cleaning and polishing glass lenses. The silicone treated tissues are used for wiping lenses. This action applies an invisible silicone surface on the glass and prevents adherence of dust, dirt or body oil, and protects lenses from minor surface scratches. Known as Sight Savers, these treated tissues are packaged in folding book style packets with plastic covers in a compact easy-to-use size.

55. Anti-Fogging Agents

FOGGING of car windows and eyeglasses can now be alleviated by application of a new anti-fogging agent made by E. I. du Pont de Nemours & Co., Wilmington 98, Del. Essential ingredient of the new material is Duponol ME Dry, a synthetic detergent which causes the moisture condensing on cold glass to uniformly spread over the surface as a clear film.

The formulation contains 700 grams of Duponol, 90 grams tannic acid, 160 grams of glycerine, together with 9 grams of dye with water to form an 8-liter solution. This material is used to impregnate a suitable cloth which, after drying, is ready for use. Wiping the glass with impregnated cloth provides an anti-fog treatment that will last several hours. The formula has not been patented and is available to manufacturers who wish to market cloth treated with this anti-fog agent.

56. Synthetic Rubber

A NEW synthetic rubber material has recently been developed by the Felt Products Mfg. Co., 1504 Carroll Ave., Chicago 7, Ill. Known as Fel-Pro 131, this material has high tensile strength and low compression set, and is claimed to have many uses by manufacturers whose operations employ rubber or rubberized sealing materials or parts. The properties are summarized as follows: Tensile strength, 1,800 lb. per sq.in.; ultimate elonga-

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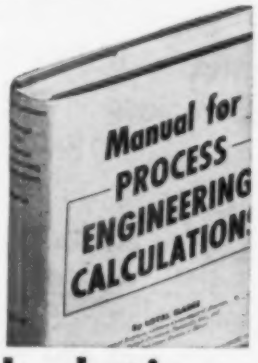

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57. Protective Coating

PROTECTION against corrosion and deterioration by use of a transparent liquid coating is now possible, according to the State Chemical Corp., 1265 Broadway, New York 1, N. Y. Called Permacote, this new coating is designed for use on metal, wood, leather, and fabric surfaces which require protection from moisture, acids, alkalis, alcohol, dyes, dirt, dust, etc. Permacote is applied by brush, spray or dip, and forms a tough transparent coating said to remain permanently flexible. It is resistant to extremes of heat or cold and will not crack or chip due to extreme changes in temperature. It is said to seal in and prolong the life of ordinary paints, lacquers and varnishes. It is available in 1- and 5-gal. cans, and in 50-gal. steel drums.

58. Surface Active Agents

RECENT increase in the production of the new K series of Ultrawets has been announced by the Chemical Products Div., Atlantic Refining Co., Philadelphia, Pa. Consisting of alkyl aryl surface agents, series K Ultrawets are now available in quantity for immediate delivery in liquid, flake or bead form. The liquid is pale amber in color, odorless, and uniform in quality. The flake and bead forms have a white color with no odor. Ultrawets are used in detergents and sanitary chemicals, for use in the textile, dairy and leather processing institutions. They are also used in metal cleaning and production of laundry compounds.

59. Vinyl Chloride Polymers

THREE new members of the Geon 200 series resins have recently been made available by B. F. Goodrich Chemical Co. The 200 series, made up of modified polymers of vinyl chloride, has included to-date Geon Resins 202 and 203, which have been standard items of production for several years. Now Geon Resins 204 and 205 are in commercial production, with Geon Resins 200 × 14 available in experimental qualities.

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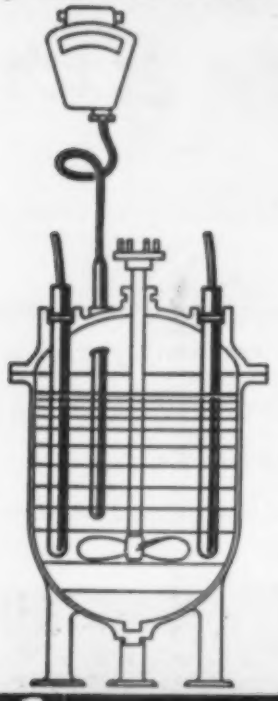

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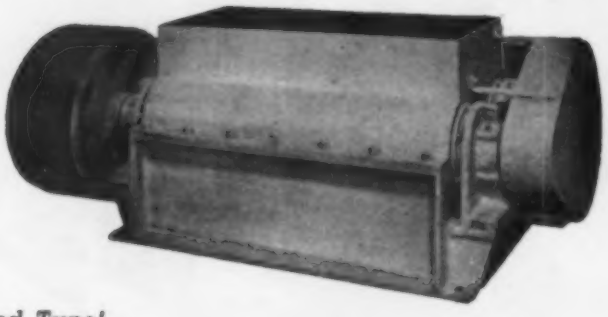

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thermoplasticity and lowering of softening point plus greater solubility. Such properties, added to the other known properties of vinyls, is expected to open up new fields of applications for these materials. Injection or compression molding materials require thermoplasticity coupled with good flow properties at processing temperatures. These resins are claimed to offer improved properties in this regard. Good solubility, another characteristic possessed by these resins, makes them useful in the solution coating field. Total solids content as high as 35 percent may be obtained with Geon 200 × 14 dissolved in methyl ethyl ketone.

60. Adhesive for Silicones

A NEW adhesive designed for bonding silicone rubber to itself and to glass, metals, and ceramics has been developed by the General Electric Chemical Department, Pittsfield, Mass. Known as G-E adhesive 12509, new type bonding agent, possessing properties similar to silicone rubber, remains flexible and resilient over temperatures ranging from −70 to 520 deg. F. and withstands continuous temperatures of 300 to 350 deg. F. in a dry air circulating oven. It can also be used to bond glass to glass, glass to metals, and metals to metals.

This adhesive is claimed to be useful in securing silicone rubber door gaskets to oven doors eliminating the need for clamps and bolts. It is also effective for joining the ends of extruded cured stock to form ring gaskets of uniform thickness. Previously these gaskets had been made by molding the loose ends of uncured stock together in a press causing one portion of the ring to be smaller than the rest.

61. Sanitizing Fabric

A SANITIZING agent containing quaternary ammonium compounds is now available in an easy-to-use form from Vestal Laboratories, Inc., 4963 Manchester Ave., St. Louis 10, Mo. Amerse tablets, as they are known, contain 30 percent active quaternary ammonium salt in an inert non-toxic filler and give 150 ppm. active ingredients in 2½ gal. of water. These tablets are said to be useful for sanitizing eating and drinking utensils and food processing equipment in rest-

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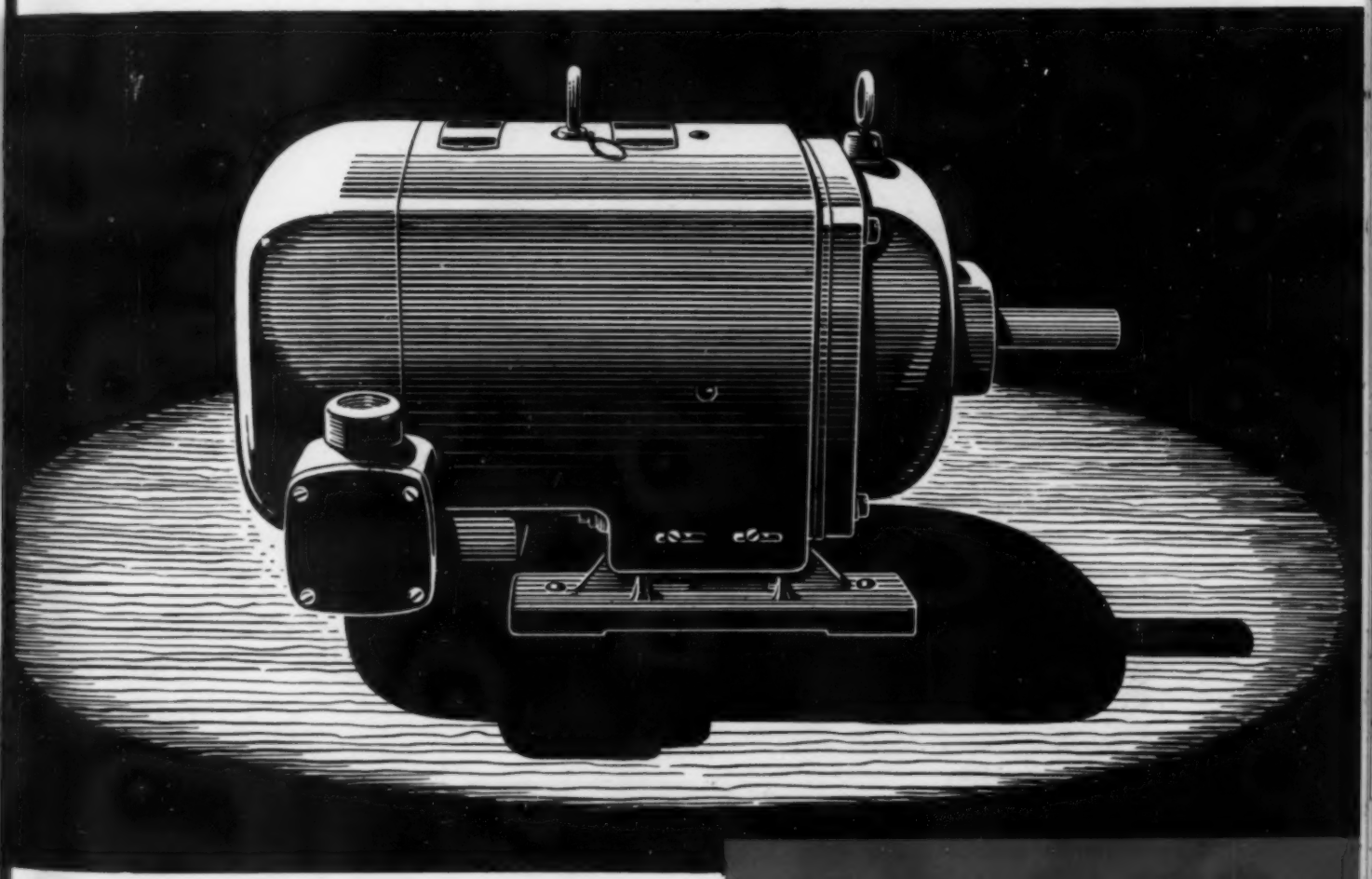

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Corrosion-proof porcelain cuts maintenance. Spoilage in materials is reduced because porcelain is permanent.

Write today for illustrated catalog #C-2, covering the ILLINOIS line of standard porcelain products. Types and sizes to meet your specific requirements. Your inquiries concerning special porcelain needs are welcome.

CHEMICAL
ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

aurants, fountains, taverns, and other food handling institutions.

62. Phenolic Adhesives

Two new modified phenolic liquid adhesives for cementing metals, thermal setting plastics, wood, fabrics, and other materials, has been announced by the Chemical Department, General Electric Co., Pittsfield, Mass. Designated as Nos. 12507 and 12508, these bonding agents, when properly cured, are said to have high shear and tensile strength, together with good resistance to water, gasoline, kerosene and mineral oil. They are recommended for cementing metal and laminations, for preparing metal spaced sandwich type construction, for attaching brackets and lugs to thin metal sheets, and for the light vehicular construction often used in trailer walls, airplane fuselage walls, and the walls of prefabricated housing. Adhesive No. 12507 is recommended for thermal setting plastics because of its flow characteristics and its high solvent resistance. Use of No. 12508 is recommended for applications in which the adhesive must possess good cleavage strength, and where high application pressures are available for assembly.

63. Glass Fabric Belting

RECENTLY announced by the B. F. Goodrich Co., Akron, Ohio, is a new type of conveyor belting using glass fabric instead of the cotton fabric employed in conventional belting. It is designed for use in conveying hot materials. In this service it has greater resistance to loss of strength than cotton fabric belting. Experimental work indicates that the glass fabric belt gives substantially longer service than the belts normally used.

64. Vinyl Coating

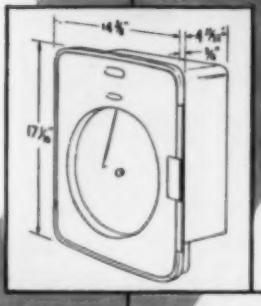
RECENTLY announced by the Amercoat Div. of American Pipe & Construction Co., Box 3428, Terminal Annex, Los Angeles 64, Calif., is a new vinyl coating. Known as Amercoat No. 88, this material is a pigmented vinyl resin dispersed in water. It will resist most acids and is unaffected by alkaline cleaning compounds normally employed in detergents. Amercoat No. 88 is said to resist all aliphatic alcohols and most aliphatic petroleum hydrocarbons, is waterproof and weatherproof, and unaffected by continuous exposure to animal and vegetable oils. In addition, it will not support the growth of bacteria mold or fungi.

Having a high solids content, this

An Ideal Case

FOR THE ADVANCED ENGINEERING FEATURES OF *M-40* CONTROLLERS

Manual Control Subpanel is *inside the case* — saving ½ or more of valuable panel area.



Check these dimensions. **The Foxboro Model 40 is the most compact recording controller available.**

Streamlined and rugged, the Model 40 Case assures the greatest operating life for controller mechanisms, and the greatest flexibility in unit combinations. Yet it is also the most *compact* controller case available. Even the manual control panel is enclosed — saving panel space and installation time.

This new case is of cast aluminum, with all parts resistant to corrosion. Special design keeps dust out when flush door is opened. New compression door gasketing keeps gas and moisture out. New hinge permits removal of door without tools or removal of case from panel. New cam-type latch is extra strong, positive in action, flush with door. The five-coat enamel finish is hand-rubbed and infrared baked for durability and appearance.

This improved case is just one of the reasons why the Foxboro Model 40 is the most-wanted pneumatic controller ever developed — why *more than 6000 units have already been delivered!* Write for Bulletin 381. **The Foxboro Company, 16 Neponset Ave., Foxboro, Mass., U. S. A.**

CHECK THESE FEATURES TOO

- Permaligned Construction
- Simplified Adjustments
- Interchangeable Units
- Wide-range Variable Reset and Derivative Resistances
- Simplified Control Relay — overload protected
- 4-Position, "Bumpless" Transfer Switch
- Exclusive Ball Linkage
- Complete range of control types and functions

FOXBORO

M-40 CONTROLLER

THE ONLY CONTROLLER WITH *Permaligned* CONSTRUCTION

NOW PROTECTO-GRAPH PROVES:

You can cut painting maintenance costs . . . *up to 70%*

Reports from plant after plant provide overwhelming evidence: Prufcoat saves 50%, 60% — even 70% — on painting maintenance. Now, to prove these amazing results are possible in *your* plant, the makers of Prufcoat have developed the Protecto-Graph Plan.

Here's how Protecto-Graph works:

Prufcoat outlasts ordinary paints as much as 10 to 1

Made from a special formulation of synthetic resins, inert pigments and volatile solvents, the Prufcoat film formed after polymerization has virtually a zero acid number, saponification number and water absorption rate. Thus, applied to floors, walls, structural steel, tanks, pipes, ducts, machinery and equipment, Prufcoat air-dries to a tough, non-oxidizing, completely acid, alkali, alcohol, oil, water and flame-proof protective coating. That's why, in the presence of strong acids and caustics, some of America's largest industrial plants report that Prufcoat outlasts ordinary paints as much as 10 to 1.

Upon request, Prufcoat Laboratories will send you a complete Protecto-Graph plan which includes a Protecto-Graph Analysis Sheet plus a sample typical Protecto-Graph. Using your own information, fill out and return the Analysis Sheet. Prufcoat Engineers will then plot a graph showing the cost of painting by your present method compared to the cost of doing the *same* job with Prufcoat. You'll be amazed to see the savings Prufcoat makes possible. So don't delay — get proof — get your Prufcoat Protecto-Graph Plan — clip and mail the coupon below *today*.

Performance-proved

"Plating department ducts that formerly corroded out and had to be replaced every few months are in good condition after three years of service."

"Prufcoat on concrete columns and walls in muriatic acid manufacturing room still in sound condition after five years — formerly repaired and repainted every few months."

"Prufcoat on cement floors, tanks, pipes, machinery and structural steel subject to acids and caustics — painting maintenance costs reduced 70%."

Send for your FREE Protecto-Graph Plan today.

PRUFCOAT PROTECTIVE COATING

Seven attractive colors that apply like paint to metal, masonry wood.

Saves more . . . because it protects more

Prufcoat Laboratories, Inc.
63 Main Street, Cambridge, Mass.

Gentlemen:

I want *proof* that Prufcoat cuts painting costs — please send me a Protecto-Graph Plan.

Name .....

Address .....

City..... Zone..... State.....

FOR MORE INFORMATION
See Reader Service Coupon on pages 159-160

coating produces a thicker film than conventional vinyl coatings. This means that fewer coats need be applied to give greater coverage and better sealing action. It is applied with a brush or spray gun and dries quickly without baking. Amercoat No. 88 does not sag or run on vertical walls and can be applied over concrete, masonry or wood surfaces without softening or lifting old paint. Comes in white, solid and pastel.

65. Water Soluble Esters

COMMERCIAL production of water soluble, oil-like esters has been announced by Glyco Products Co., 26 Court St., Brooklyn 2, N. Y. These esters are non-ionic, non-toxic, light in color, and fluid or grease-like in consistency. Consisting of polyoxyethylene oleates and laurates having molecular weights above 800, these esters dissolve clearly in water, alcohol, esters, hydrocarbons, and vegetable oils. At 20 deg. C. they are slightly heavier than water. They have high boiling points and exhibit surface acting properties.

These new esters are marketed under the names of polyethylene glycol monooleates and polyethylene glycol monolaurates. They are suggested for use as detergents in textile and fiber processing; as penetrating lubricants; as grinding media for pigments; as plasticizers for water dispersed products and water insoluble resins, elastomers, plastics, coatings, etc.; emulsifying agents for oils and hydrocarbons.

66. Flooring Material

INTRODUCED by the Chemical Products Div., Goodyear Tire & Rubber Co., is a new stain, scar and flame-resisting flooring material possessing the resilience and long wearing qualities of rubber. The new material is a calendered vinyl product containing plasticizers, stabilizers, pigments and colors. It is resistant to moisture and alkalis, and has been tested against beverages, cleaning agents and chemicals usually found in the home. One characteristic is that if ignited it will extinguish itself when withdrawn from direct contact with flame. This thermoplastic material can be installed in either strip or tile form and is easily fitted around sharp corners without cracking.

BS&B PRESSURE-VACUUM VENT VALVE

1. Cover
2. Base
3. Diaphragm Plug
4. Retaining Ring
5. Retaining Ring Spring
6. Vacuum Ring
7. Shock Absorber
8. Hinge Pin

for BETTER PROTECTION *against* VAPOR LOSS

The Black, Sivalls & Bryson Pressure-Vacuum Vent Valve provides positive two-way protection while minimizing vapor losses from tanks containing benzol, alcohol, gasoline and other products economically stored under slight pressure.

Automatically sealed against escape under normal pressures, hinged valve cover lifts clear if over-pressure occurs, providing quick relief. When vacuum develops, atmosphere lifts patented B S & B diaphragm to permit in-breathing.

Available in a full range of sizes—2″ to 24″ diameter. Larger sizes suitable for manway use. Write for full information to Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Bldg., Kansas City 6, Mo.

SPECIFICATIONS

Model Number	Size, Inches	Standard Opening Pressure, Ounces	Maximum Opening Pressure, Ounces	Standard Opening Vacuum, Ounces
2VVH	2	3	16	½
3VVH	3	3	16	½
4VVH	4	2	16	½
6VVH	6	2	16	½
8VVH	8	2	16	½
10VVH	10	2	16	½
12VVH	12	2	10	½
16VVH	16	2	8	½
20VVH	20	2	6	½
24VVH	24	1½	4	½

EFFICIENCY RELIABILITY

FOREIGN INQUIRIES INVITED Cable Address: BLACK, KANSAS CITY, U.S.A.

BLACK, SIVALLS & BRYSON, INC.

KANSAS CITY, MO. OKLAHOMA CITY, OKLA.

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Have you considered stainless steel for every application where its corrosion resistance, everlasting brightness and long life will save money or increase the sale of your product? You can easily try it because Ryerson stocks of Allegheny stainless are as near as your telephone and we're just as pleased to furnish a single piece for experimental work as a large shipment for quantity production.

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Allegheny stainless brings gleaming brightness and long life. Your nearby Ryerson plant brings fast, friendly service. So step up the performance of your equipment, the quality or appearance of your product with Allegheny stainless from Ryerson stocks. Contact the plant nearest you.

JOSEPH T. RYERSON & SON, Inc. Steel-Service Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

DO YOU WANT A CURRENT LISTING OF RYERSON STAINLESS STOCKS?

We would be glad to send you the current Stainless Steel Stock List, showing sizes actually on hand in the following stainless products:

Plates	Hexagons	Angles	Pipe Fittings
Sheets	Squares	Pipe	Welding Electrodes
Rounds	Flats	Tubing	Fastenings

RYERSON STEEL

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

New England Chemists Hold Golden Anniversary Dinner

FOUR HUNDRED members and guests of the Northeastern Section, American Chemical Society, paid tribute on February 12 to Dr. Gustavus J. Esselen on the section's fiftieth anniversary. Many outstanding leaders of the profession were present. The gathering took place at the Harvard Club of Boston under the chairmanship of Dean Chester M. Alter of the Graduate School, Boston University, present head of the section. Dr. Charles A. Thomas, executive vice president and technical director, Monsanto Chemical Co., and president of the ACS, gave the principal address. This followed the presentation to Dr. Esselen of a Golden Anniversary honor scroll given in memory of Prof. James Flack Norris, for many years director of the chemical research laboratory of the Massachusetts Institute of Technology and twice president of the society.

Dr. James Bryant Conant, president of Harvard University, occupied the chair at a technical meeting held in the afternoon. Prof. George B. Kistiakowsky of Harvard read a paper on "The Physical Chemistry of Detonation" and Prof. Karl P. Link of University of Wisconsin gave one on "The Anticoagulant Dicumarol."

Dr. Esselen has been a member of the society since 1909 and is a past chairman of the section. A native of Roxbury, Mass., he received his Ph.D. from Harvard in 1912. In 1930 he became president of the Esselen Research Corp., Boston. He is now chairman of the board of registration for professional engineers in Massachusetts, a director of the American Institute of Consulting Engineers, and prominent in other organizations.

The scroll presented to Dr. Esselen recounted his 39 years of active membership in the Northeastern Section, official services, public speaking and radio broadcasts known as "Chemistry of Today." In his reply Dr. Esselen emphasized the contributions of many section members to its progress and spoke of the personality and achievements of the late Prof. Norris.

President Thomas made a plea for a deeper conception of America's mission in a troubled world, the broadening of scientific concepts to include a far greater awareness of world-wide human needs, better control of specialized technology in the face of improved social growth, and advancement of cultural essentials.

Texas City is rebuilding. In the background is the Monsanto plant with many new buildings under construction. Wreckage of warehouses has been cleared away in the foreground

GROUP OF LEADERS AT BOSTON BANQUET—L. to r., (seated), Mrs. Karl P. Link; President James Bryant Conant, Harvard University; and Mrs. Gustavus J. Esselen. L. to r. (standing), Dean Chester M. Alter, Boston University; Dr. Gustavus J. Esselen; Dr. George B. Kistiakowsky, Harvard University; President Charles A. Thomas, ACS; and Dr. Karl P. Link, University of Wisconsin

Commercial Solvents Plans Large Research Expansion

COMMERCIAL SOLVENTS CORP. has announced plans for an extensive expansion of the research and development department at Terre Haute, Ind. Two million dollars will be spent

for new buildings and equipment. Plans have been approved and construction will begin shortly. The program calls for more than doubling the size of the present research building, construction of a new bacteriological pilot plant unit, a separate building for a high-pressure research pilot plant, and an addition to the pharmacological laboratory. Kenneth H. Hoover, vice president in charge of research and development, estimates that the staff will be increased by 150.

The expansion is part of a long range plan conceived to provide adequate research facilities in proportion to the expanded activities of Commercial Solvents. It is designed to implement the functions of the research and development department which are to conceive and receive ideas for new products, develop processes for improving the quality and lowering costs of existing products, as well as to find new uses for old products.

One of The Texas Co.'s two new Hydrocol pilot plants located at Montebello, Calif. They produce synthetic gasoline from natural gas. Each unit is rated at 6,000 gal. per day. They are part of a million-dollar annual research program on liquid fuel synthesis. Texas has already licensed two commercial plants for this process, will license others

Oil Chemists Will Hold Annual Meeting in May

CURRENT activities of the American Oil Chemists' Society are centered in plans for the 39th annual meeting in New Orleans on May 4-6 at the Roosevelt Hotel, and in nominations for the 1948-49 officers. They will be elected by mail prior to the meeting. T. H. Hooper of the Southern Regional Research Laboratory, New Orleans, is general chairman, K. S. Markley is program chairman and S. O. Sorenson, Archer-Daniels-Midland Co., Minneapolis, is in charge of nominations.

Surplus Carbon Black Plant Sold in New Mexico

PURCHASE of a government-owned carbon black plant near Eunice, N. M., by Panhandle Carbon Co., Inc., New York, for $1,600,000 has been announced by WAA. Terms of Panhandle's bid call for a down payment of $235,000.

Costing some $2,661,000 and operated by Panhandle during the war, the plant has a yearly capacity of 7,500 tons carbon black manufactured by the channel process. Equipment includes burners, scrapers, conveyors, air separators, pulverizers, an absorber and a reactivator. There are also about 8.5 mi. of feeder pipeline and housing accommodations for employees.

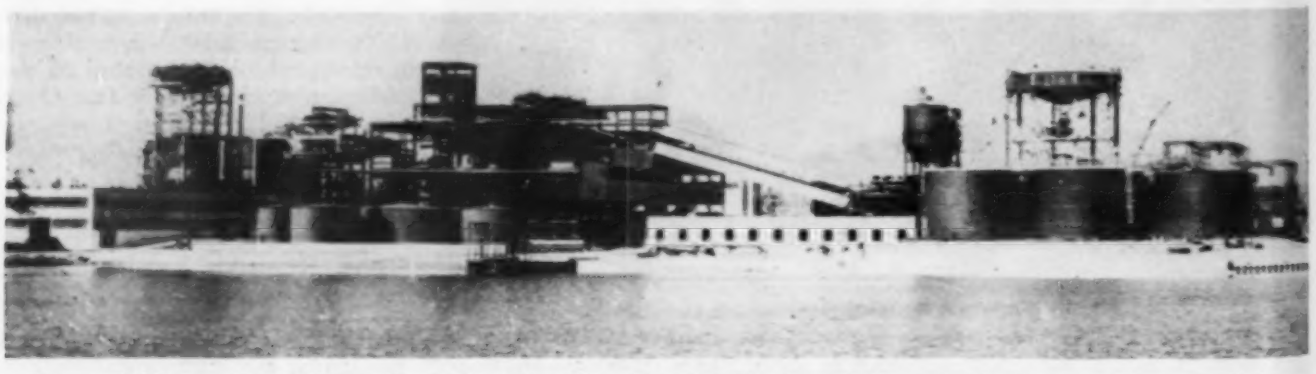
Penn State Sets Up Chemical Engineering Department

A SEPARATE department of chemical engineering has been established at Pennsylvania State College. Dr. D. S. Cryder is department head. Penn State was one of the first colleges to develop a curriculum joining engineering and chemistry when its industrial chemistry curriculum was offered in 1903. This action therefore gives official standing to a course which has been operating as a unit of instruction for 45 years.

Bartow Phosphate Plant Will Open in March

THE Noralyn phosphate mine and plant being built near Bartow, Fla., by International Minerals & Chemical Corp. is expected to be in operation this month. The projected output is 1.5 million tons per year, the largest production from such a mine in the western hemisphere, according to officials. When the new mine is in operation its production, coupled with that of the company's Peace Valley and Achan mines near Bartow, will give the company a total phosphate output of 3.5 million tons annually from Florida. Life of the new mine is expected to be at least 25 years.

Until a drier is completed at the Noralyn mine later this year the product will move for drying and shipping



Output of this new plant at International Minerals & Chemicals Co.'s Noralyn mine is expected to be 1.5 million tons of phosphate per year. It will be the largest in the western hemisphere

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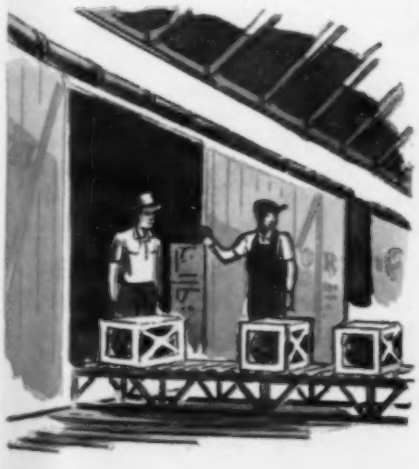
Do You Need General-Purpose, squirrel-cage motors from 1 to 200 hp? Get in touch with your nearby Allis-Chalmers *Authorized Dealer* or District Office. Either may be able to help you from stock right now!

But For Really Big Motors — 250 to 25,000 hp and over — call your Allis-Chalmers *field engineer*. He's an *expert* on motors—can help you solve difficult drive problems, involving large or small motors, in the most economical manner.

Want Reliable Information on motor delivery? Call *either* your Allis-Chalmers dealer or district office. They have *up-to-the-minute* delivery information available to them!



Motor "Headquarters"—½ to 25,000 hp and Up!

YOU SELECT from a *wide range* of motors when you call on Allis-Chalmers. And you can count on *expert* motor advice, too! The best possible motor selection is the result of careful appraisal of drive characteristics, the driven equipment, power source and surroundings. The best motor may not always be the first that meets the requirements.

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from other company facilities in the vicinity.

Results of Job Survey Announced by NYU

RESULTS of a survey of recent engineering graduates on conditions of employment were announced in February by Dean Thorndike Saville of New York University's College of Engineering. The data disproved a popular belief that most young engineers must go out of town for jobs. Over 60 percent of the graduates located in the metropolitan area. The questionnaire was sent out last fall and asked each man for details concerning his position, how it was obtained, what salary was paid at the beginning and later, and whether or not the job is satisfactory.

Analysis of replies revealed that: 79 percent accepted technical positions in private industry or in civil service; 15 percent are teaching or are pursuing graduate studies; 4 percent accepted non-technical positions (such as sales); and 2 percent are unemployed.

In answering the question "what was your source of job information?" the results were as follows: 27 percent

James H. McGraw (1860-1948)

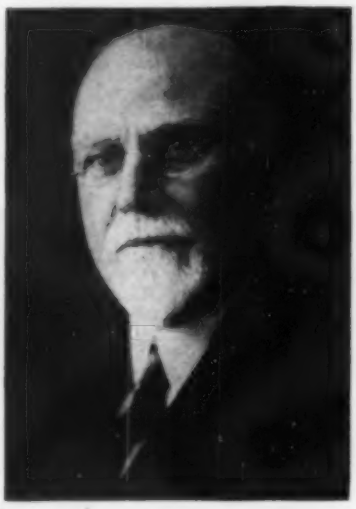
JAMES H. McGRAW, dean of industrial publishers, died in California Feb. 21, 1948 at the age of 87. He began his publishing career in 1884 as a subscription salesman and progressed steadily through one of the most colorful careers in publishing history. He laid the foundation for the largest industrial publishing organization in the world, the McGraw-Hill Publishing Co., and the McGraw-Hill Book Co., largest publishing house specializing in technical and industrial books. Mr. McGraw is credited also with having raised industrial publishing to a new standing in the publishing field.

His life began Dec. 17, 1860, in Panama, Chautauqua County, N. Y. He attended the State Normal School at Fredonia, and at the same time, taught at a district school. Upon graduation from normal school, as valedictorian, in 1884, he was appointed principal of the district school, in which he had taught.

When Chautauqua County friends started *The American Journal of Railway Appliances* and purchased a little paper called *Steam*, the temptation was too much. He left his country school house to make his fortune in New York by selling subscriptions.

Even in those early days, he had a vision of the future possibilities of business publishing, but the venture did not turn out as happily as he had anticipated. By the summer of 1886, the company owed him $1,500, with no prospects for payment. Called into conference and asked if he would help by finding some ready cash, he replied that he would. He did.

He borrowed $1,000 and took stock for that amount as well as for the $1,500 due him, and thereby became a vice president of the



James H. McGraw

little publishing house. Two years later the company paid a 10 percent dividend.

Another important point in his career came when he and his partner parted company over a difference of opinion as to the importance of Edison's new electric car. Mr. McGraw foresaw the doom of the horse-car and his first official act as an independent publisher was to hire an electrical editor for his *Street Railway Journal*. Almost immediately, developments in that industry proved he was right. By 1901, he had acquired *Electrical World* and *Electrical Engineering*, later consolidated as *Electrical World*.

In the spring of 1902 a group of engineers and scientists interested in the budding electrochemical industry met in Philadelphia and formed the American Electrochemical Society. They also sensed the need for a new publication that should serve as an exponent of the electrochemical industry. Logical line of action was through Capt. W. D. Weaver, editor of *Electrical World*, to James H. McGraw, its owner and publisher.

It was proposed that Mr. McGraw should establish a new magazine that would also be the official organ of the new society. The suggestion was not favorably received because Mr. McGraw recognized as a sound publishing policy the necessity of maintaining an industrial magazine independent of outside affiliations and of an official character. Proponents of the idea still urged him to enter the electrochemical field because it was wholly unoccupied and promised an exceptional opportunity for success and service. As a result, Mr. McGraw incorporated in 1902 the Electrochemical Publishing Co. and in September of that year began publication of *Electrochemical Industry*, predecessor of *Chem. & Met.*

Upon the death in 1916 of John A. Hill, the McGraw Publishing Co. acquired the Hill publications. The McGraw-Hill organization began with nine national publications.

He resigned on Dec. 27, 1935, as chairman of the Board of Directors, when his responsibilities were taken over by his son, James H. McGraw, Jr. He continued always to maintain an alert interest in the company.

Mr. McGraw married Mildred F. Whittlesey June 8, 1887, and they had four sons, James H. Jr., now president and chairman of the board of the company; Harold W., vice president in charge of the McGraw-Hill Building at 330 West 42nd St., New York; Curtis W., senior vice president and treasurer; and Donald C., vice president in charge of manufacturing. They also had a daughter, Mrs. John E. Osmun of Madison, N. J.

Battery of 173,000-gallon storage tanks for storage of cellulose acetate at Tennessee Eastman Corp.

from these 173,000-gallon storage tanks

They're Alcoa Aluminum . . . to protect the purity and color of cellulose acetate. Aluminum does not discolor, contaminate, nor react with this chemical . . . nor with scores of other chemical products that are stored and processed in aluminum equipment.

Each of these tanks is 98 feet high and 18 feet in diameter and designed to hold 173,000 gallons of cellulose acetate. Welded joints are strong, liquid-tight, and can be made in the field. Erection and fabrication costs are lowered.

Alcoa Aluminum does not stain or discolor the products handled. Therefore, chemicals stay water-white. Aluminum is inert to many chemicals and foods. It is non-sparking, can be used safely in the production and storage of inflammable and explosive materials.

Our chemical engineers will be glad to help you in designing aluminum process equipment. Write to ALUMINUM COMPANY OF AMERICA, 2151 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in 54 leading cities.

ALCOA FIRST IN **ALUMINUM**

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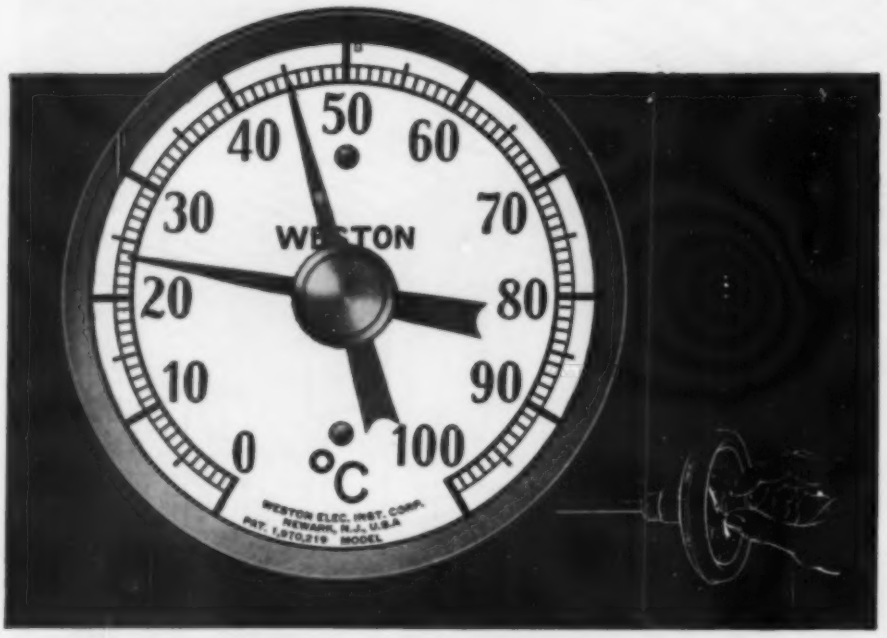

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all metal

MAX-MIN* THERMOMETER

What's the present processing temperature?

What was the highest temperature reached since last reading?

You want the answers to both these questions—and the MAX-MIN gives them . . . accurately!

The red index pointer on the MAX-MIN is manually set to either the low or high side of the main indicating pointer. When set on the high side, for example, it moves as the temperature increases, always remaining at the extreme temperature reached, until manually re-set. Thus one quick reading gives both *present* temperature and the *peak* temperature since last reading.

For complete details see your jobber or local Weston representative. Weston Electrical Instrument Corporation, 590 Frelinghuysen Avenue, Newark 5, New Jersey.

*Registered Trade Mark

WESTON *Instruments*

N.Y.U. placement bureau; 14 percent faculty; 18 percent personal inquiry; 14 percent family or friends; 27 percent newspaper, agency, or engineering societies.

Average salary figures reported in various engineering fields were: Administrative, $206 per month; aeronautical, $218; chemical, $250; civil, $237; electrical, $257; and mechanical, $247.

New Sodium Sulphate Output Starts Soon in Nevada

FULL-SCALE commercial operations by Nevada Chemical Co., a subsidiary of Florida Pulp & Paper Co., will soon be getting under way at Rhodes marsh, eight miles south of Mina, Nev. According to reports, some 500 tons of anhydrous and crystalline sodium sulphate will be recovered daily from natural deposits. Cost of the project is said to be several hundred thousand dollars. Products are reportedly going to three large pulp and paper firms.

A source of sodium products before

CONVENTION CALENDAR

National Association of Corrosion Engineers, fourth annual conference, Jefferson Hotel, St. Louis, Mo., April 5-8.

Third Southern Machinery and Metals Exposition. Municipal Auditorium, Atlanta, April 5-8.

Midwest Power Conference, sponsored by Illinois Institute of Technology, Sheraton Hotel, Chicago, April 7-9.

American Society of Lubricating Engineers, annual convention, Statler Hotel, Buffalo, April 19-21.

American Chemical Society, 113th national meeting, Chicago, Ill., April 19-23.

17th Packaging Exposition, Public Auditorium, Cleveland, April 26-30.

American Oil Chemists' Society, spring meeting, New Orleans, May 2-6.

American Institute of Chemists, annual meeting, Hotel Pennsylvania, New York, May 7.

American Institute of Chemical Engineers, regional meeting, Hollenden Hotel, Cleveland, May 9-12.

Second Engineering Progress Show, Franklin Institute, Philadelphia, May 11-16.

Society of Plastics Industry, annual meeting, Ambassador Hotel, Atlantic City, May 20-21.

American Society for Testing Materials, 51st annual meeting, Book-Cadillac Hotel, Detroit, June 21-25.

DO YOU NEED TO

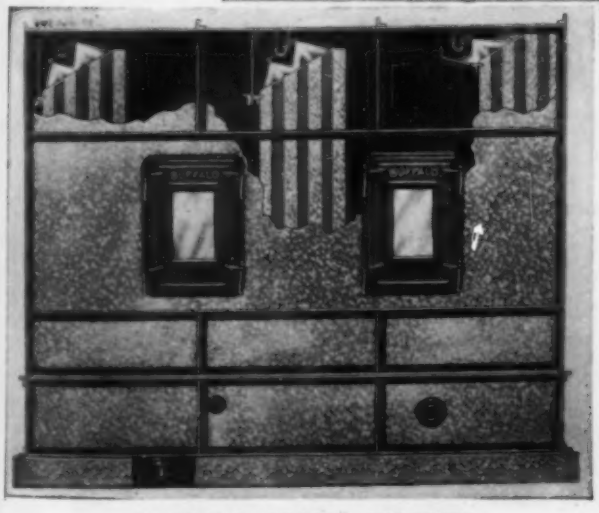
Get Rid of Dust?

"Buffalo" Wet Glass Cell Air Washers are doing a big job in chemical industries removing dust for process control and employee efficiency. Fans draw the air through curtains of fine spray and then through glass fibre filters, in these extremely thorough air cleaning units. Compact, easily serviced, low in operating cost. Wide variety of models and capacities to handle your particular need. Bulletin 3457 gives all construction and performance data. Write for your copy.

BUFFALO WET GLASS CELL AIR WASHER

DO YOU NEED TO

Salvage Dust?



BUFFALO STATIC WASHER

If you have a valuable dust by-product, "Buffalo" Static Washers will "pull it out of the air and save it for the cleanout man" on an economical continuous-service basis! Working on the principle of removal by sprays and scrubber plates, these units are easily cleaned out and require little other attention for a good many years. For dust salvage, you can't beat a "Buffalo" Static Washer. Write us for all the facts — Bulletin 3142-C.

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- ★ HEATING
- ★ COMFORT COOLING
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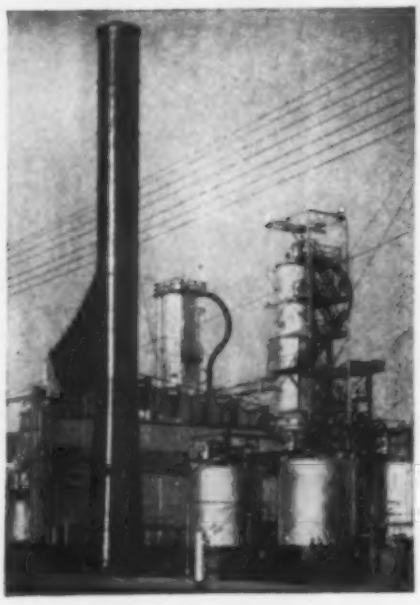

THERE are more Layne well water systems serving petroleum producers and refineries than all other makes combined! And this same overwhelming preference is true with just about every major industry in the Nation. With petroleum producers now using more water than ever before, their Layne well water systems are paying handsome dividends in giving absolutely dependable high peak production.

First of all, Layne well water systems and Layne vertical turbine pumps have always been noted for their superior engineering features. Next, they have always been manufactured from the finest materials available. And last, but very important, they are always installed according to Layne's exclusive standards. The results have been—more water, lower operation cost and longer life.

All of this adds up to the fact that for any situation demanding large quantities of well water at the ultimate in low cost, there is no equal to a Layne well water system. For literature address Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

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Westvaco Chlorine Products Corp. is bringing soda ash up 1,500 ft. to the head-frame over its trona deposit near Green River, Wyo. From the head-frame it goes to the building in the center. Here it is crushed and calcined. Capacity of the unit will be 100–150 tons daily. In the future, this operation will probably be integrated with the company's elemental phosphorus plant under construction in Idaho

1900, Rhodes marsh was later deprived of economic value by the inflow of irrigation water. Present operations will mine the raw sodium sulphate by dragline. As one pond is scooped out, water will be pumped into it from the pond currently being worked. After crushing, the product is purified in a classifier and dried in a 120-ft. rotary kiln similar to those used in the cement industry. President of Nevada Chemical Co. is General Jarmon. Henri Withington is chief chemist and in charge of operations.

Continental Will Build New Refinery in Spring

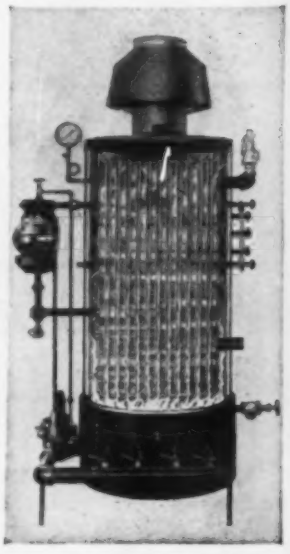
CONTRACT for construction of its new $8,500,000 refinery at Billings, Mont., has been signed by Continental

THE ANSWER TO YOUR STEAM PROBLEM

A KANE BOILER PACKAGE

Yes, it's a compact, self-contained steam source that includes: the correctly sized KANE Automatic Gas-Fired Boiler complete with burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

Engineered Steam at its best with four decades of experience at your disposal—so, send your steam problem to us for study and recommendation.



The KANE Boiler is built to A.S.M.E. specifications, in sizes to 30 H. P.

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No guesswork!

READCO BLENDERS are "tailored" to fit your operation

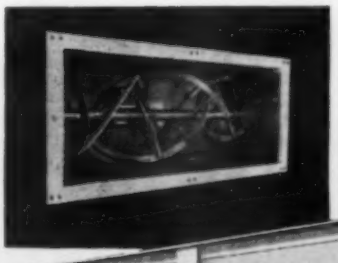
Whatever blending problems you have, READCO Blenders can solve them... because they are "individually tailored" to fit your particular operation. In addition, these "plus features" provide years of dependable service with less maintenance.

AGITATOR SHAFT is mounted in outboard anti-friction bearings.

SHAFT PACKING GLANDS are independent of bearings.

COUNTER FLOW AGITATOR prevents build-up of material at either end.

SPECIAL DESIGN permits vertical removal of agitator from blender.



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Two operations in one machine—Saves time—Saves labor—Saves material losses

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Oil Co. First announced last fall, the plant will have a daily crude capacity of 7,500 bbl. and approximately 700,000-bbl. storage capacity. Design will incorporate the most modern catalytic cracking, catalytic desulphurization, polymerization and solvent extraction of asphalt. Products will include high-octane gasoline and a full line of burning fuels and road asphalts.

Crude oil will come from Continental's Frannie, Elk Basin, South Elk Basin and Cat Creek properties. Major part of the construction work will begin this spring, although some essential buildings have already been completed. Refineries presently operated in the West by the firm are located at Denver, Colo., Glenrock, Wyo., and Artesia and Farmington, N. M.

Slayter Receives Medal For Industrial Research

MEETING in Rye, N. Y., the Industrial Research Institute awarded the 1948 Institute medal to Games Slayter. He is vice president in charge of research and development, Owens-Corning Fiberglas Corp. The award was made as a result of his outstanding leadership in developing glass fibers and finding commercial applications for them. H. Earl Hoover, vice president, Hoover Co., presented the medal. Other highlights of the meeting included papers on government and university relationships to industrial research.

Texas Gulf Sulphur Opens New Deposit in Texas

TEXAS GULF SULPHUR CO. will open the first new sulphur mining operation in Texas in more than 10 years when the company begins production in a few months from new properties near Wallisville and about 11 mi. south of Liberty on the Trinity River. Consolidated Steel Corp. is in charge of construction of the plant. The company has secured rights over more than 3,000 acres and may expand this holding.

Production is expected to be approximately 250,000 tons per year. About 100 employees will be required for the operation. C. L. Orr is assistant manager in charge of construction of the new plant, which will come under the general management of H. E. Treichler.

Pesticide Shipments Exempted Briefly

NORMAL stocks of economic poisons delivered by the manufacturer, prior

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Above: Accurately controls baking time of bread in direct gas-fired tunnel oven.

Above: Maintains constant tension, reduces stretch of yarn on slasher in textile mill.

Above: Regulates speed of rotary table on welding positioner, for continuous weld.

Left: Provides infinite speed adjustability on lumber planer and matcher.

Above: Varies speed as required in filter processing of synthetic rubber.

Provides infinite, accurate speed flexibility within 2:1 to 16:1 ratio

Proved in thousands of installations in scores of industries, REEVES Variable Speed Transmission is the original compact and mechanically correct unit which drives production machines at infinitely variable speeds—making available instantly the most efficient speed for each different operation. It covers the entire speed range smoothly, without steps and without interrupting production . . . maintains any desired speed without fluctuation. Available in sizes fractional to 87 hp, both horizontal (illustrated) and vertical types, either open or enclosed designs. Choice of manual (handwheel), electric remote (push button) or entirely automatic controls.

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- ROTATING SEALS OF GRAPHALLOY ARE UNEXCELLED

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Sinclair Refining Co.'s new research and development laboratory is rapidly approaching completion at Harvey, Ill. The administration building is on the left and is directly connected to the main laboratory building by a covered passage at the ground floor level. The square building in the foreground will house six individual pilot plant units. A boiler house and shop building can be seen directly beyond the pilot plants. The other two completed buildings serve as distillation, compounding and lube testing laboratory (right), and as a catalyst activity laboratory (left)

to Dec. 25, 1947, in the case of rodenticides and herbicides and prior to June 25, 1948, in the case of insecticides and fungicides, have been declared exempt from provisions of the new Insecticide Act of 1947 under the following conditions: (1) In the case of an insecticide or fungicide, it must not be in violation of the provisions of the Insecticide Act of 1910. (2) In the case of a rodenticide or herbicide, it must be effective for the purposes intended and not likely to cause injury to the public when used as directed. (3) The period of exemption is limited to one year from the date upon which the act becomes effective with respect to the particular product—that is, the exemption expires on Dec. 25, 1948, in the case of rodenticides and

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TOTALIZING-INDICATING
METER
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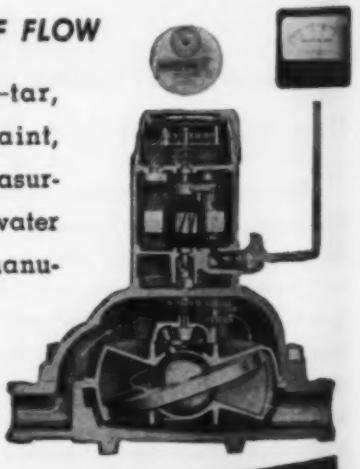
REMOTE INDICATION OF RATE OF FLOW



For practically all liquids—tar, molasses, crude oil, grease, paint, varnish, syrups, etc., etc.—for measuring, indicating, totalizing flow of water and chemicals in continuous manufacturing processes and numerous other uses. Its remote indicating feature is new—get the complete story.

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COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

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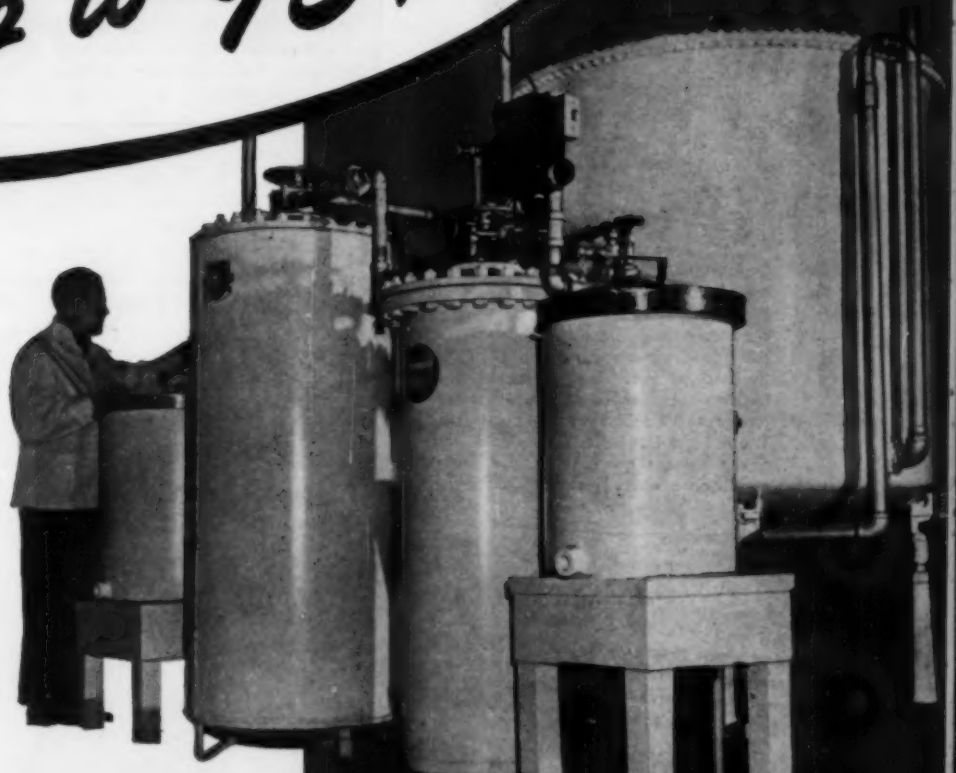

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Compare costly, sparingly-used distilled water with Permutit's Demineralized Water.... It's up to 95% cheaper! In nearly every case Demineralized Water can be substituted for distilled!

In the Demineralizing process, Zeo-Karb* H, Permutit's acid regenerated organic cation exchanger, replaces metallic cations in the water with hydrogen ions, converting the salts present into corresponding acids. Then these acids are removed from the water by De-Acidite*, a resin-type anion exchanger.

For details write the Permutit Company, Dept. CE-3, 330 West 42nd St., New York 18, N. Y., or the Permutit Company of Canada, Ltd., Montreal.

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FOR 34 YEARS

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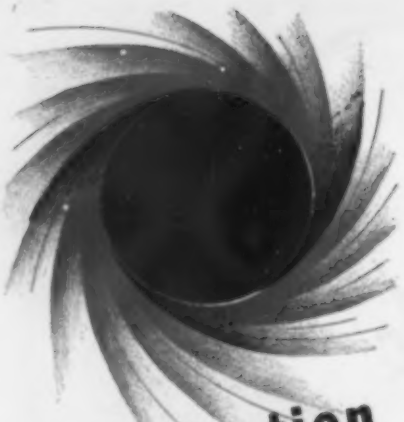

lubrication at terrific speeds

Operation speeds of many production machines have reached an all time high. Speeds above 25,000 R.P.M. are common today. There are LUBRIPLATE lubricants especially well adapted for high speed use. They reduce friction to a minimum, arrest progressive wear and protect against rust and corrosion. There is a LUBRIPLATE lubricant for every need regardless of operating conditions. Write for particulars.

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Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE

Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

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Monsanto's new phenolic plastics plant in Springfield, Mass., is part of an expansion program that will double its phenolic plastic capacity. Complete effects of the program will not be felt until the last half of the year when the company's new phenol and formaldehyde units are in full operation

herbicides; and on June 25, 1949, in the case of insecticides and fungicides. (4) This exemption may be revoked at any time, either as a whole or as it applies to any particular product if such action appears to be in the public interest. This rule was effective January 19.

Scientific School Centennial Held by Harvard

DISTINGUISHED physicists, chemists and engineers gathered at Boston on February 13 to celebrate the one-hundredth anniversary of the founding of the Lawrence Scientific School, predecessor of the Harvard Graduate School of Engineering and pioneer of the era of modern science in this university. President James Bryant Conant of Harvard was toastmaster and the other speakers at an evening dinner in the Harvard Club of Boston were Dr. J. Robert Oppenheimer, Director of the Institute for Advanced Study at Princeton, N. J.; and Dr. Vannevar Bush, Director of the

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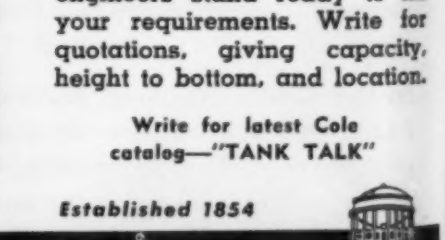

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Water Tube Design

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- All Steel Construction.
- Positive Tidal Circulation of Water—maintains all parts at equal temperature.
- Condensate Return System Built-in as an integral part of all boilers of 60 h.p. and up.
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- Large Combustion Area . . . Three-Pass Heat Baffling gives high thermal efficiency.
- Choice of Fuel — Gas, Oil or Coal or any combination of these fuels to meet fuel requirements of your plant.
- Fully Equipped for Automatic Operation—with the finest accessories. As nearly automatic as a boiler can be.
- A.S.M.E. CODE — National Board Approved. Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.
- Full Range of Sizes from 10 h.p. to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.
- Can Be Fired Over Rated Capacity and still maintain high thermal efficiency.

Power Engineers Agree: STEAMASTER is the Boiler with PLENTY OF GUTS!

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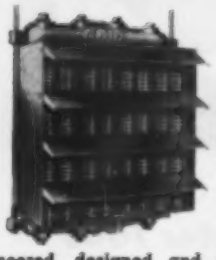

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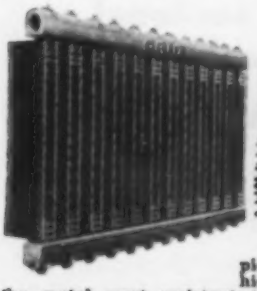
More "free" area per foot of heating space in GRID products than any other. Hence, no clogging due to dust, lint, etc. And, easier to keep clean and operate at highest efficiency.



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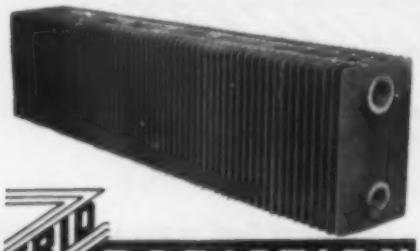
GRID heating sections are one piece construction high test cast iron — the metal most resistant to corrosive gases. Hence, no rotting away of heating elements, no leakage due to corroded joints, connections.

No electrolysis because no dissimilar metals are used in GRID construction. Hence, no maintenance expense — but years of trouble-free heating service.



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Real savings in your fuel bills because GRID units are designed for lower outlet temperatures and greater air delivery. Hence, warm comfortable air to the working zone where it is needed.

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WAUSAU, WISCONSIN

Carnegie Institution in Washington. Stress was laid upon the importance of freedom of scientific research and the need to cultivate far-reaching professional ideals of ministry to the public welfare by scientists and engineers.

National Dairy Sells Aralac Plant

THE Aralac plant of National Dairy Products Corp. has been sold to Virginia-Carolina Chemical Corp. With the sale of the Taftville, Conn., plant, National Dairy plans to stop production of casein type fibers. Virginia-Carolina plans to produce vegetable-protein fibers at Taftville.

ACS Will Hold National Meeting in Chicago

MEETING in Chicago, the American Chemical Society will hold its 113th national meeting from April 19 to 23. Dr. Charles Allen Thomas, president of the society, reports that better fuels from petroleum, developments in paints and plastics, new water purification techniques and safer method for handling radioactive material will be discussed. Several hundred technical papers will be presented. They will cover practically every branch of chemical science. Seventeen professional divisions of the society will sponsor meetings.

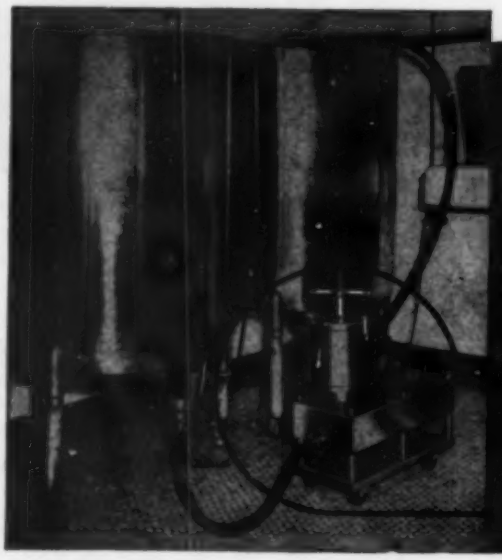
General headquarters for the meeting will be at the Stevens Hotel. Division meetings will be held also in the Palmer House, Sherman, Congress, La Salle, Sheraton and Hamilton Hotels.

Goodrich Chemical Expands At Avon Lake

A NEW $3 million chemical plant at Avon Lake, Ohio, will be built this spring by B. F. Goodrich Chemical Co. W. S. Richardson, president, reports that the new plant will be erected next to the company's experimental station. Various chemical products now in development or semi-commercial stage will be produced. They will supplement the company's present polyvinyl chloride resin, synthetic rubber, and other organic chemical products.

Sanitary Science Lab Opened at MIT

THE William Thompson Sedgwick Laboratories are the latest addition to the facilities of the department of civil and sanitary engineering at the Massa-



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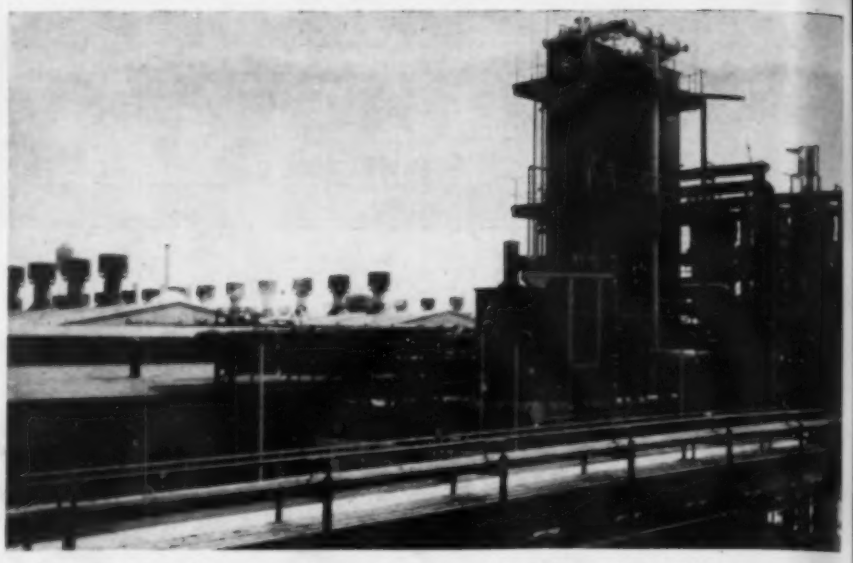

Chlorine is purified here. This unit is part of Southern Alkali Corp.'s new Lake Charles, La., plant which is making caustic soda and chlorine

chusetts Institute of Technology. The new laboratories of sanitary engineering, sanitary chemistry and research, and sanitary bacteriology and research are designed to meet modern educational procedures in teaching sanitary engineering and to provide a thorough knowledge of the chemical and biochemical reactions which take place in the treatment of water, sewage and industrial wastes. Prof. William E. Stanley, professor of sanitary engineering, is in charge of the laboratories. Dr. Clair N. Sawyer is director of the sanitary chemistry and chemical research laboratories which are equipped with the latest apparatus needed for teaching and research in sanitary chemistry. The sanitary engineering laboratory under the direction of Prof. Ariel A. Thomas, has equipment for laboratory scale operating units in-

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AN OUTSTANDING SEMI-METALLIC PACKING for stuffing box service on pumps, valves, mixers and the like handling gasoline—water—air—steam—oils—and chemicals.
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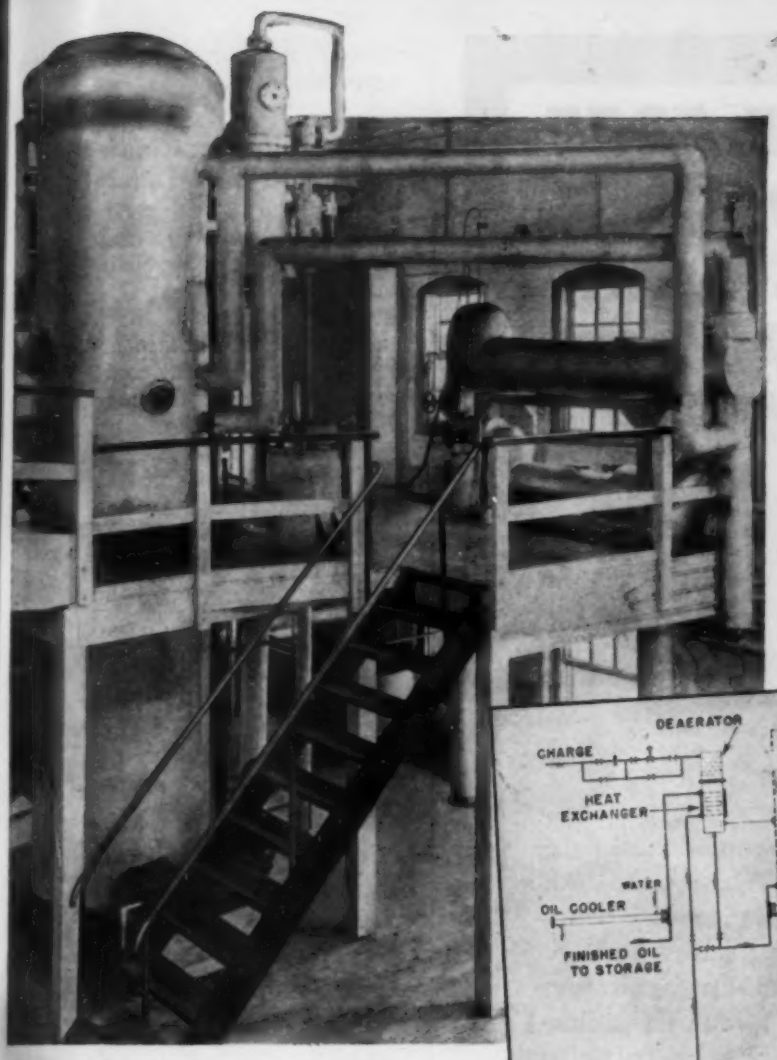
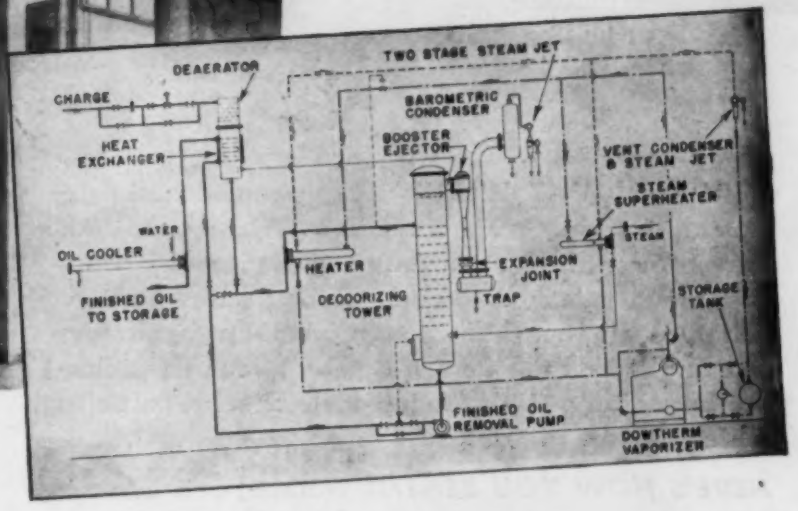


ARMOUR

installs three more FW systems for deodorization of edible oils



For the third time in ten years, Armour and Company, Chicago, has selected Foster Wheeler equipment for continuous deodorization of salad oils and shortening. The confidence shown in this equipment by this important food processor proves its efficiency, reliability and economy.

FW systems for continuous deodorization are designed and constructed to meet individual requirements. Among advantages afforded are: Less stripping steam used per pound of oil processed because of intimate counter-current contact between stripping steam and oil; heat losses are held down by employing heat recovery devices not practicable in batch systems.

With continuous deodorization, the oil is subjected to the processing temperature for much less time than in the conventional batch method.

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Non-Contaminating
Drip Tight
Working Parts Isolated From Flow
Non-Clogging
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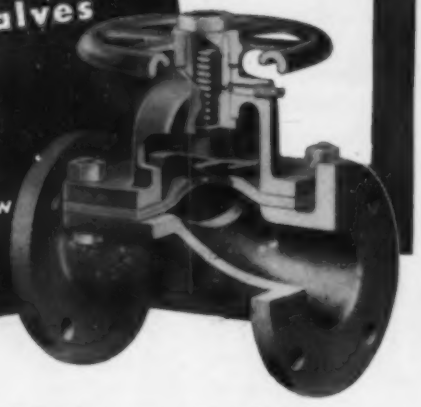
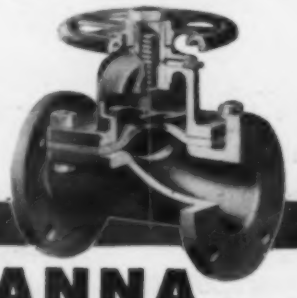


HERE'S HOW IT WORKS Diaphragm completely isolates working parts from flow. When open, the unrestricted flow area minimizes pressure drop. Diaphragm attached to compressor assures positive action at all times. The tough, resilient diaphragm seats tightly on the weir providing a leak tight closure by molding itself around scale or solid particles which may be present.

HERE'S HOW YOU BENEFIT Nothing gets into the bonnet to corrode working parts—Nothing enters the line to contaminate products. No repacking necessary—valves won't stick or clog. The only maintenance is occasional diaphragm replacement, while the valve body stays in the line.

Find out how you can obtain more efficient, lower cost flow control—ask for Catalog V-47, HILLS-McCANNA CO., 2341 W. Nelson St., Chicago 18, Ill.

For air, water, gases, acids, alkalis, vacuum, slurries, volatile and viscous substances, semi-solids, etc. Hand wheel and lever operated—air, motor or chain operated. Rubber or glass linings, or special linings to suit conditions. Cast iron bodies, or corrosion-resisting alloy, Haveg or stoneware bodies. Sizes from ¾" to 14".



HILLS-McCANNA
diaphragm valves
saunders patent

Proportioning Pumps
Force-Feed Lubricators · Magnesium Alloy Castings

volved in water, sewage, and industrial water treatment.

AGA Will Hold Conference In Canada

ANNUAL AGA sales conference on industrial and commercial gas will be held in Windsor, Ont., Canada, April 7-9. The program has been prepared under the chairmanship of Harry A. Sutton. The three-day conference will be divided to cover different phases of the gas industry. The first day will be given over to industrial gas subjects. On April 8, the morning and afternoon sessions will cover subjects of general interest. On the last day commercial gas subjects will be discussed by the speakers.

Sterling Drug Opens New Gulfport Plant

A NEW processing plant for the manufacture of milk of magnesia is located in Gulfport, Miss. It was formally opened by Chas. H. Phillips Co. division of Sterling Drug Inc., in a ceremony attended by state and local officials.

The 72,000 sq. ft. plant is one of the first new major drug manufacturing establishments to be put in operation in the deep South since the end of the war. A simplified process developed at the Phillips plant in Glenbrook, Conn., will be used at Gulfport. The building was especially designed to accommodate the new type of equipment used in the new process, and to allow for packaging and storing the finished product.

Industry Briefs

Johns-Manville Corp. consolidated net earnings in 1947 were $9,486,633 or $3.23 per share of common stock, compared with $5,836,613 or $2.01 per share in 1946. Earnings are adjusted for a three-for-one split of the common stock in May, 1947. The earnings were equivalent to 7.1 cents in the sales dollar.

Freeport Sulphur Co. net earnings for 1947 amounted to $3,110,710 or $3.89 a share on the 800,000 shares of common stock, according to the company's preliminary report submitted to directors by Langbourne M. Williams, Jr., president. These earnings compare with $3,753,316 or $4.69 a share for 1946.

Monsanto Chemical Co.'s 1947 sales, excluding its British and Australian subsidiaries, amounted to $143,403,-

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CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

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MAKE PROCESSING
simpler • safer • speedier • smoother

Tolhurst Suspended Centrifugals are designed for large scale processing of heavy chemicals. They operate efficiently whether slow or fast starts or repeated short cycles at full speed are required. Centrifugally operated clutch provides greater flexibility in loading and unloading and more economical use of power. Baskets can be perforate or imperforate. Baskets and covers constructed of welded steel, steel rubber-covered, stainless steel, monel or other corrosion resistant material. Basket sizes: 26", 32", 40" and 48". Fume-tight covers, feed pipe, spray pipe and unloading plow available when specified. Write today for catalog and prices.

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Tolhurst Centrifugals

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East Moline, Illinois
In Canada: American Machine and Metals (Canada) Ltd.
[illegible]

161. Unaudited net earnings for the year were $15,561,228. This was at the rate of $3.59 per common share, earnings for the fourth quarter being 73¢ a share. At the end of the year 4,253,019 common shares were outstanding. Earnings do not include any recovery from insurance claims covering loss of profits nor have they been charged with the continuing expenses resulting from the destruction of the company's Texas City plant last April.

Dow Chemical Co. has released its trademark rights to the name saran. This was done to permit its use as a generic name for vinylidene chloride copolymer resins.

Esso Standard Oil Co. is the new name of the Standard Oil Co. of New Jersey, according to M. J. Rathbone, president. Headquarters are now located in the new Rockefeller Center Esso Bldg. at 15 West 51st Street, New York.

American Council of Commercial Laboratories has made Dr. Harold M. Dudley executive secretary and publicity relations counsel.

Phillips Petroleum Co. will build an extraction plant in Hansford County, Tex., to recover liquefied petroleum hydrocarbons and natural gasoline. Slightly more than 50,000 gal. per day of such hydrocarbons will be produced.

Continental Oil Co. has announced that it will spend $1 million on modernization of the 100 octane aviation gasoline plant at Ponca City, Okla., which the company has bought from the Government for $3.1 million.

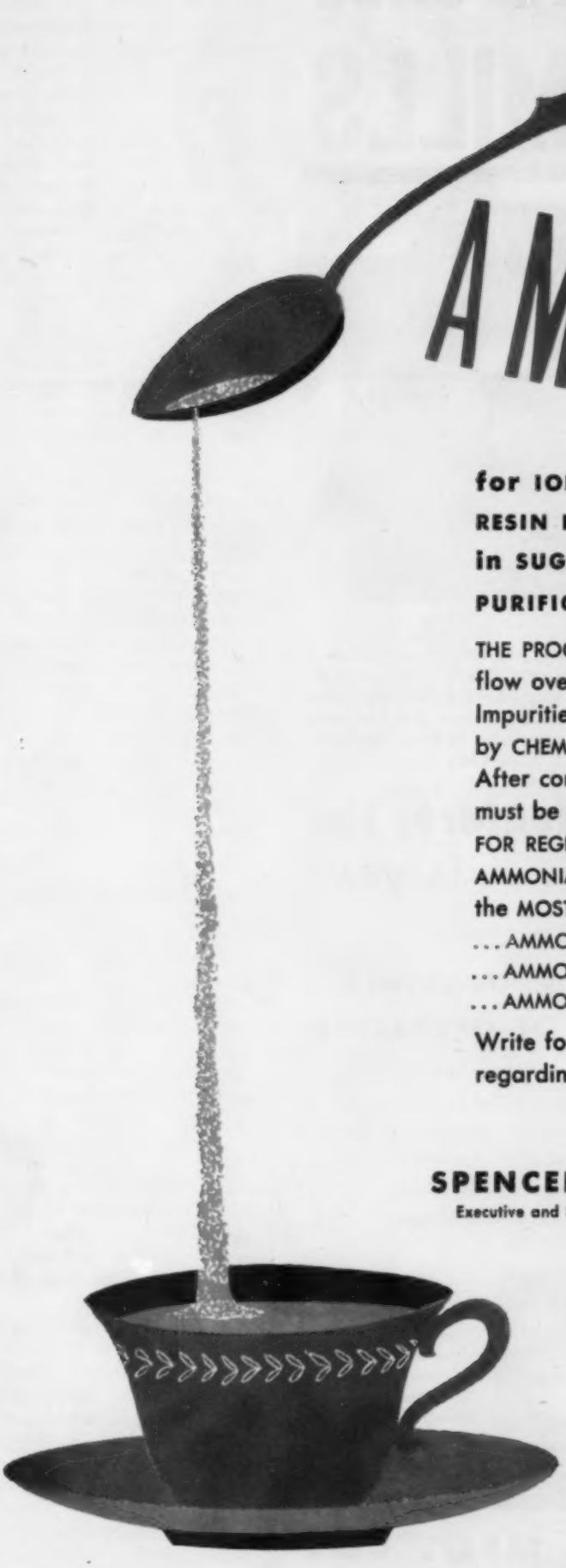
Consolidated Chemical Industries is spending approximately $200,000 at its plant at Baton Rouge, La.

READERS' VIEWS and COMMENTS

"Rest in Peace"

To the Editor:

Sir:—I have been much interested in the articles by Mr. John Christie in the January and February issues, dealing with the disposition of the fabulous I. G. Farben. Before this cartel came into existence, the writer had extensive dealings as a consulting engineer with a number of the larger chemical companies which went into



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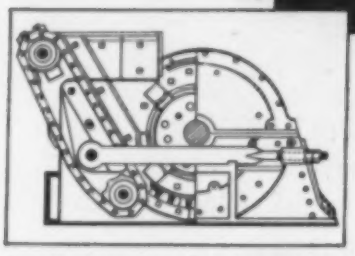

Uniformly high quality of product . . . enormous crushing power . . . lower drying costs . . . result from the Continuously Moving Breaker Plate . . . the patented non-clog feature that accounts for Dixie's greater efficiency. At left—Sectional View of the Dixie Non-Clog Hammermill.

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the combine. In the general condemnation of the I. G. Farben cartel, the fact is overlooked that there is a great deal of credit due to this organization and its associated companies.

Prior to World War I, industrial chemistry in the real sense of the word did not exist outside of Germany. A large number of the most important chemical developments necessary to modern industry were made in Germany. Perkin, a British chemist, accidentally discovered the principle of synthetic aniline dyes, but the development was done in Germany. A German concern worked out 605 formulas for Salvarsan and spent $4,500,000 in the effort, before a satisfactory product of the 606th formula was placed on the market. In the important field of fertilizer, the fixation of atmospheric nitrogen by the cyanamide process and the synthetic ammonia process were both German developments. There were hundreds of similar cases which could be cited, including the basic groundwork for nuclear fission ten years before the atomic bomb was even thought of in this country.

In spite of its evils, the I. G. Farben cartel served a useful purpose and now that the complete disintegration is about to take place, we can say "Rest in Peace."

James E. Cassidy
Consulting Engineer,
3015 Rodman St. N.W.,
Washington 8, D. C.

Our Memories Slipped

To the Editor:

Sir:—The article on the direct application of anhydrous ammonia to the soil as fertilizer which appeared on pages 114-17 of your January issue was of considerable interest to us, particularly since no mention was made of the fact that this process was developed by Shell.

While we have no desire to detract from the excellent work done by others in promoting the use of this important method of fertilizing, we should like to indicate Shell's early position in this field and to point out the work that has been done since by us.

Work on the direct application of ammonia to field crops was begun by Shell in California about ten years ago. This work was highly successful and it was established that anhydrous ammonia was an effective fertilizer and that it could be applied cheaply in controlled quantities by means of special equipment. As a result of these investigations, patent application was made for this so-called Nitrojection process on July 26, 1939, and on June

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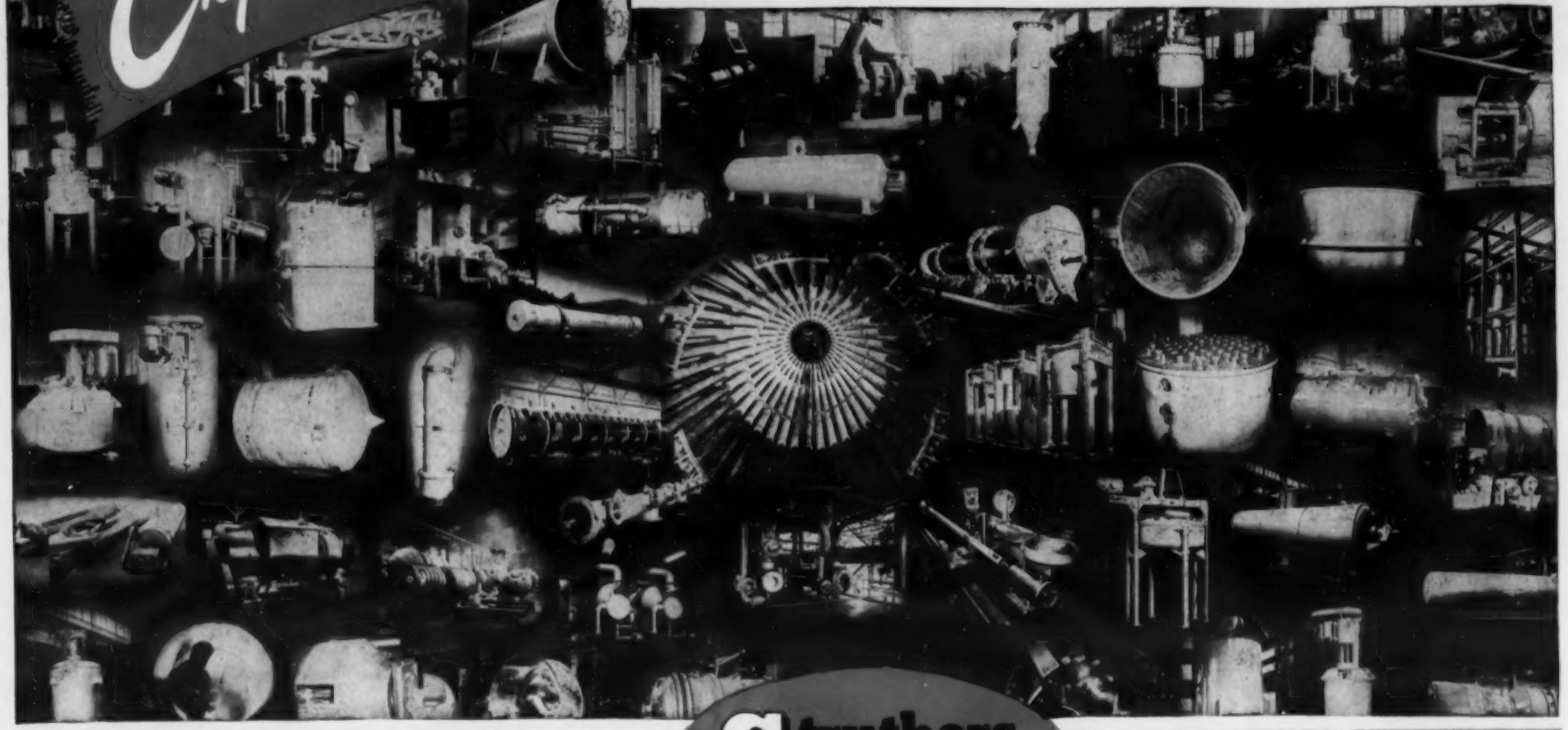

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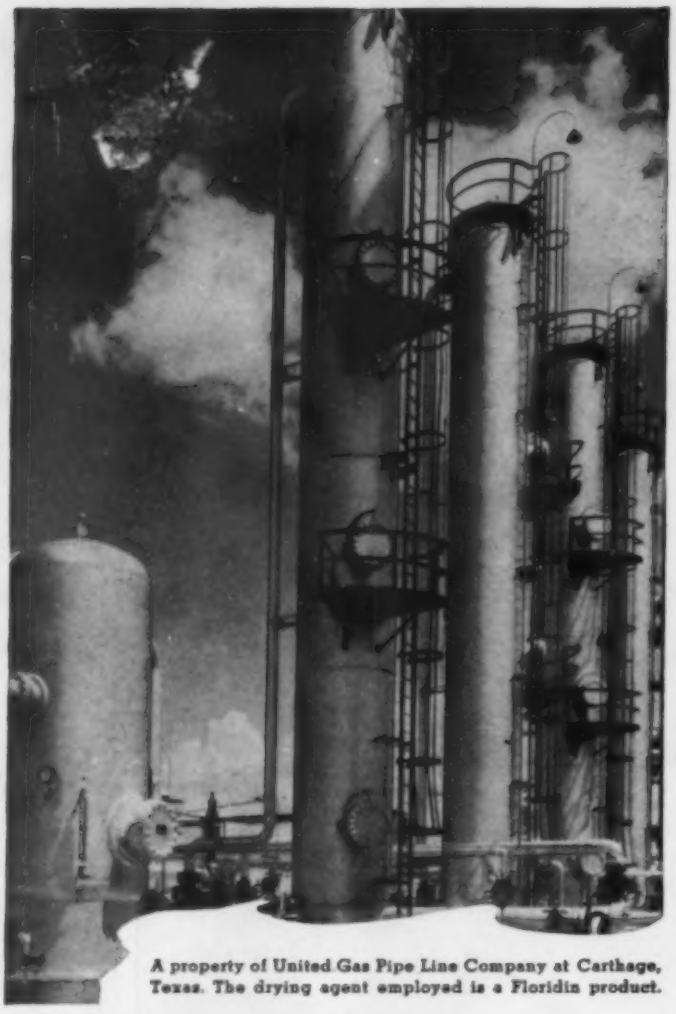
OFFICES IN PRINCIPAL CITIES



A property of United Gas Pipe Line Company at Carthage, Texas. The drying agent employed is a Floridin product.

for **ADSORBENTS and DESICCANTS . . . turn to**

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BAUXITE Made from the most suitable selected bauxite by special methods of activation and mechanical adaptation, Floridin products have been found superior to other granular desiccants for many industrial uses. More specific information will be given on request.

FLORIDIN COMPANY
ADSORBENTS

Department A, 220 Liberty St. Warren, Pa.

9, 1942, U. S. Patent No. 2,285,932 was granted and assigned to Shell Development Co. covering this new method. Following the completion of this early developmental work and the granting of the patent, agriculturalists connected with both the government and educational institutions, particularly in the South, were made familiar with this new method of fertilizing and the techniques we used.

Shell's efforts to promote the Nitrojection process were considerably handicapped during the war because of the severe shortage of ammonia. Consequently, the process has not been too widely publicized, but it was known to the farmers in the Central California area where it was developed and in certain other areas of the Far West where limited commercial applications were begun. Since the war, Shell has renewed its interest in this process, and as ammonia becomes more plentiful it is our intention to promote it more actively. Last year 47 percent of our agricultural ammonia sales in northern California went to Nitrojection as compared to 23 percent in 1946 and 21 percent in 1945. So you see, the process is definitely on a commercial basis so far as we are concerned.

I hope you will find these additional points a helpful supplement to the account which you recently published.

JAN OOSTERMEYER

President,
Shell Chemical Corp.,
San Francisco, Calif.

The official sources of the information we published were indicated in the footnote on page 117. Unfortunately, these bulletins and articles did not refer to the pioneering work done by Shell technologists in the application of anhydrous ammonia first to irrigation water and later more directly to the soil. And by slip of our own memories we failed to remind our readers of our own observations reported in our issues of November 1931 (pp. 366-7) and September 1938 (p. 493).—Editor.

Ch. E. Fundamentals

To the Editor:

Sir:—If chemical engineering beginners do nothing more than thoroughly digest your editorial and Dr. Stine's review of Dr. Kirkbride's new book, "Chemical Engineering Fundamentals," both in the January issue of *Chemical Engineering*, they will have acquired worthwhile information.

Although there seems to be a minor difference of opinion between Kirkbride and Stine about the value of

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results from pilot plants, the explanation is simple. It is only a matter of interpreting the effects of the application of fundamental principles.

When commercial plant performance does not equal that of a pilot plant, an answer can usually be found for it. In small scale operations fundamental principles may, in some cases, be automatically taken care of by the size of the equipment, which fact may not be appreciated. When the size is increased many fold for a commercial plant, this may be overlooked. Reduced efficiency is the result. This may happen in the best of organizations. However, if the effort can be justified, it should be possible to obtain as good performance in a commercial as in a pilot plant.

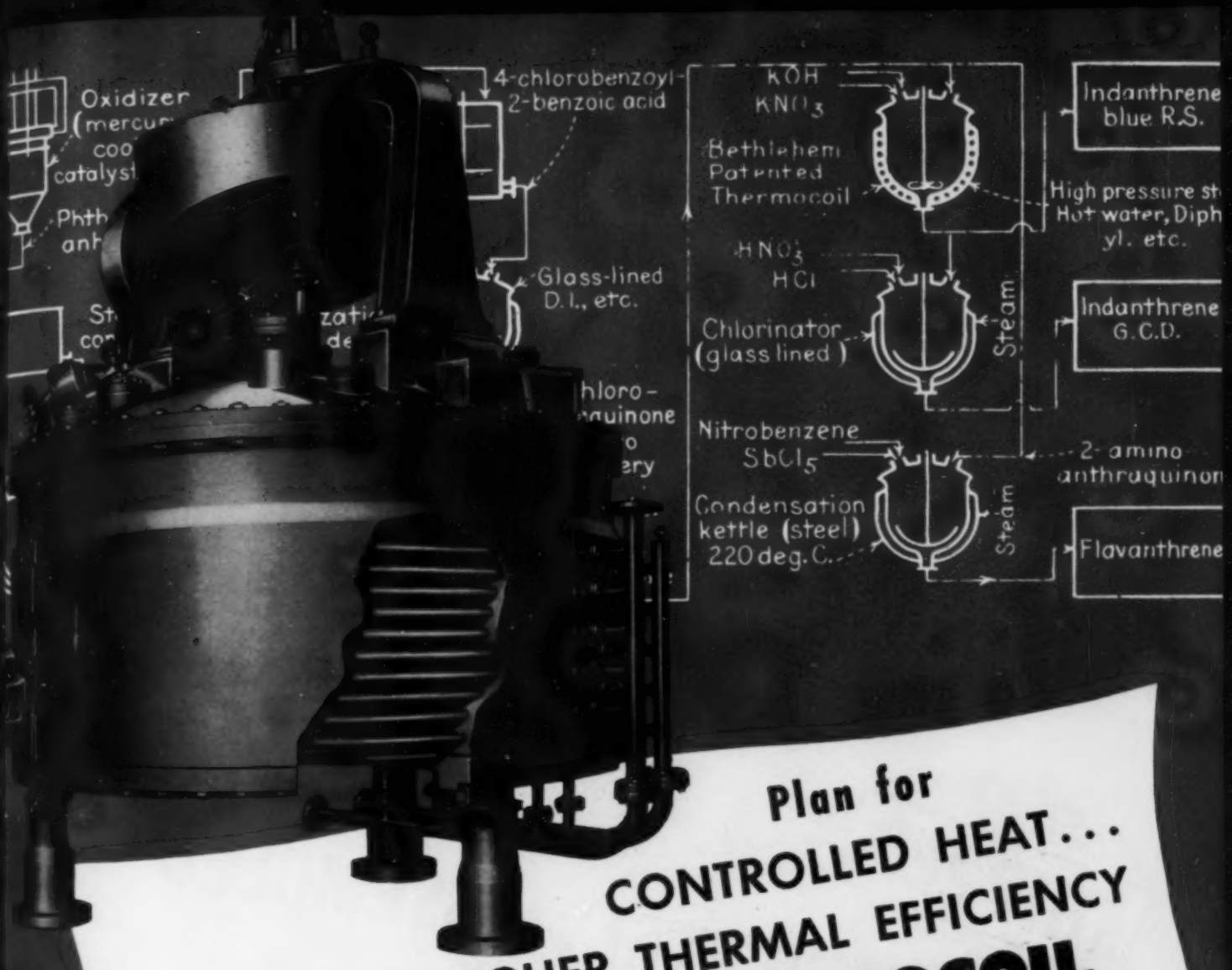
On the other hand, when commercial plant performance exceeds laboratory or pilot plant results, it is usually because, in the case of the latter, the control of process variables has been difficult. This is particularly so where small volumes are concerned at elevated pressures. Control becomes less difficult with larger volumes of fluids. The type of equipment required for the process is also an important factor.

One of the major causes of difficulty in scaling up a process may be due to just magnifying the size of the pilot plant equipment. In other words, as has been emphasized, the unit operations are considered the fundamentals rather than mere applications of the fundamental principles. It is a common and costly mistake. Unfortunately it sometimes happens that, if fair results are obtained on a commercial scale, then months and years, expensive ones, may be spent juggling process variables trying to approach laboratory results before, if ever, there is an appreciation of the basic cause of the trouble. Manufacturing scale experimentation, under these conditions, may be expensive but the cost can be greatly reduced if the cause of the trouble is recognized soon enough and elementary tests are made to determine whether fundamental principles are being properly applied.

If the book has just a slight influence on beginners (and on older practitioners, too), it will fill a long felt need because usually each new crop learns the hard way. An appreciation of the importance of fundamental principles seems to take a long time to acquire. As an older practitioner, I am looking forward to reading Dr. Kirkbride's book.

WALTER COOPEY

Engineering Consultant,
Belle Works,
E. I. du Pont de Nemours & Co.,
Charleston, W. Va.



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When quick temperatures at exact levels are desired . . . and controlled uniformity over the entire interior of the vessel . . . specify Bethlehem Thermocoil equipment.

Its patented construction utilizes a series of coils of steel tubing cast integral with the wall of the vessel. Through these tubes steam, hot water or other liquids under pressure are continuously circulated and provide more rapid rate of thermal transfer. Result? More even distribution of heat accurately controlled, higher thermal efficiency.

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Conkey Self-Supporting Evaporator Effects are shipped to you as a unit, with vapor body, heating element, and entrainment separator completely assembled. Thus, upon arrival at the site, it swings into place just as simply as you would erect any tower. Once you get a derrick over it, the job is practically done.

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NEWS FROM ABROAD

Special Correspondence

McGRAW-HILL *World News*

Enso-Gutzeit plans new kraft mill in Finland . . . Indian firm reopens Mithapur soda ash plant . . . South Africa expands its paint industry . . . New asphalt plant will be constructed in British Columbia . . . British penicillin plant turned over to private firm by Ministry of Supply . . . Zagreb Fair coming in May . . . New natural gas reservoir found in northern Italy . . . Britain pushes new construction in chemical industry . . . France relaxes controls on chemical industry . . . Australia gets new pulp and paper mills.

Construction of New Kraft Mill Planned in Finland

ACCORDING to Wm. Lehtinen, general manager of the Enso-Gutzeit combine, this firm contemplates the erection of a big new mill in connection with its Kaukopaa sulphate pulp mill (present annual output about 110,000 tons). The output of the new mill is to be 60,000 tons per year. The kraft liner machine has been ordered from Beloit Iron Works. The time of delivery is over one year, and in the meantime the necessary extensions are being undertakn at Kaukopaa to accommodate it. Quantity of sulphate pulp available for export will not be affected by the erection of the new mill as steps will be taken to correspondingly increase the production of Kaukopaa sulphate mill. Construction of the new kraftliner mill will start in spring 1948.

Ash Plant Is Reopened By Indian Firm

OPERATING far below capacity, and still beset by many technical difficulties, Tata Chemicals, Ltd., one of India's major chemical concerns, has just restarted its soda ash plant after a shutdown of nearly a year.

The soda ash plant, located at Mithapur in Kathiawar, has a rated capacity of 36,000 long tons a year but has never run "all out." The shutdown was caused by two factors; first a failure of the seasonal rains and, second, because of modifications made at the suggestion of Yungli Chemical Industries Ltd., China, the firm's technical consultants.

Other lines at the plant were operated on a restricted basis below their rated capacities—bleaching powder, rated at 45,000 long tons; liquid chlorine, 1,000 tons, and caustic soda, 7,500 tons.

Only in the production of salt was an advance made. Because of this division's work the yearly profit came to about $120,000 which was applied against past losses of more than $900,000.

Paint Industry is Growing In South Africa

SOUTH AFRICA, with 50 paint manufacturing organizations, appears to be headed for self-sufficiency in this catagory within the next few years. There is still insufficient manufacturing machinery to meet the normal demand for paint, but imports from the United Kingdom promise to solve the problem.

In view of the high price of linseed oil from the Argentine, various schemes are being tried to grow linseed in South Africa. Another paint ingrediant, tung oil, is currently grown in Swaziland and northern and eastern Transvaal.

Argentina Will Build Three New Refineries

ARGENTINE government has issued a decree authorizing M. W. Kellogg Corp. to construct three new petroleum refineries with productive capacity of 4,500, 1,500, and 1,000 cu. m. daily. The arrangement was ordered by President Peron in order to alleviate the pressing fuel shortage in Argentina. One of the plants to be erected at La Plata, near Buenos Aires, will cost about $32,000,000. First step was the extension of an irrevocable letter of credit in favor of the Kellogg firm for the amount of $6,000,000. If the added capacity of the new refineries amounts, as it is believed it will, to 2.5 million cu. m. per year, it will increase Argentina's home capacity by 62 percent.

In addition to attempting to secure more crude from Venezuela and Trinidad, Argentina has commissioned another U. S. firm, the Drilling and Exploration Co., Nevada, to drill 40 exploratory wells at a cost of $12,500,000. Argentina at present gets about 40 percent of its total consumption from its own fields.

New Asphalt Plant Will Be Built in British Columbia

STANDARD OIL CO. OF BRITISH COLUMBIA, LTD., will commence construction of a new asphalt plant at a cost of almost $500,000. The company's Stanovan Refinery on the south shore of Burrard Inlet in Burnaby has been chosen as the site. The new plant will provide facilities for the manufacture, blending and shipping of asphalt and cut-back asphalts.

It is scheduled to go into production early in April 1948. Facilities will provide for the manufacture of a wide range of asphalts under vacuum and at temperatures so low as to ensure the preservation of highest quality. While extraction of asphalt products will lower the percentage of fuel oil available for sale, the actual quantity will not be reduced, because the additional facilities will not only provide for the manufacture of asphalts but will also substantially increase the total refinery capacity. Included in the construction project are new tank trucks and tank car loading facilities, an additional boiler, and the erection of 13 additional storage tanks.

When completed, the asphalt plant

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will have a daily capacity of about 175 tons of finished products, including all grades of paving asphalts and cutback asphalts. In the future, the company may manufacture roofing asphalt products.

British Firm Takes Over Speke Penicillin Plant

DISTILLERS CO., LTD. has taken over control of the penicillin factory at Speke. Since December, 1945, the company has operated the factory as agents of the Ministry of Supply. A new company, Distillers Co. (Biochemicals), Ltd., has been formed specially for the purpose, and arrangements have been made for the output of penicillin to be distributed by several houses. E. G. Gross, director and general manager, said recently that work on streptomycin has now reached an advanced stage and, within a matter of months, they hoped to have their pilot plant in full production. The whole of their initial output would be used for research.

India Expands Its Copra Program

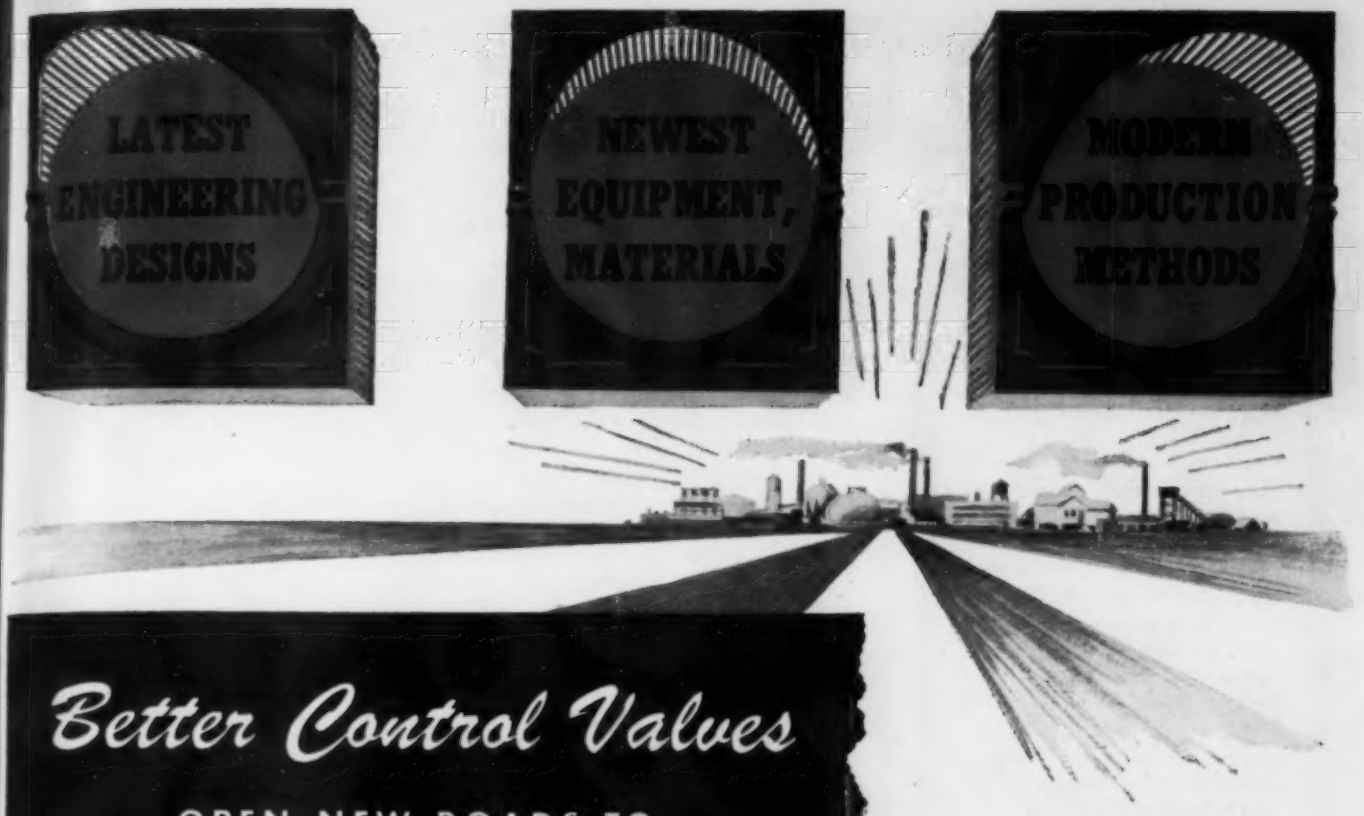
SHOOTING at a goal of self-sufficiency in copra, India has approved a program calling for the establishment of coconut nurseries in Madras, Bombay and Assam provinces which will be supplying approximately 300,000 seedlings annually within five years. Work will be directed by the Indian Central Coconut Committee. Partition of India does not affect the Indian Dominion's copra position significantly. Of the average annual production India produces 3,361 million nuts and 105,000 tons of oil and Pakistan only 61 million nuts and 5,000 tons of oil. India now imports 100,000 tons of copra annually.

Zagreb International Fair Will Be Held in May

PLANS for the second postwar Zagreb International Fair have been announced. This year the fair will be held from May 8 to 17. Albania, Belgium, Bulgaria, Czechoslovakia, France, Holland, Hungary, Italy, Poland, Switzerland, Free City of Trieste, Russia and Yugoslavia will display their first postwar products.

New Natural Gas Reservoir Found in Northern Italy

A NEW source of methane gas, reported to be about 10 billion cu. m. in extent, has been discovered by the



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With the *new* K & M regulators the process industries get a green light to more accurate, trouble-free control of pressures, flows, temperatures, and liquid level.

The reason is simply this: *K & M engineers* were given a green light when the line was designed. "Forget what's been done in the past," they were told. "Produce something better . . . to meet the process industries' needs *today.*"

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Kieley & Mueller engineers combine the most up-to-date equipment offered today with their company's half-century background of experience. They are eager to apply this combination to the solution of your control valve problems, new installations or replacements.

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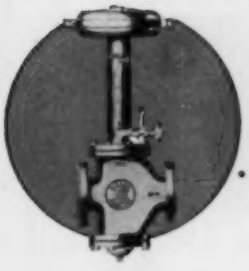
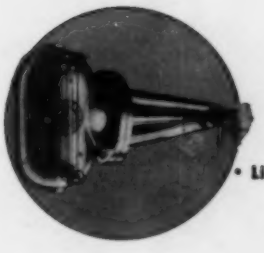


• Diaphragm Valves



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Societe Metanifera Ravennate between Ravenna and Ferrara. At a depth of five to six hundred meters, the reservoir is currently being tapped at the rate of 3,000 cu. m. per day. Arrangements are being made to connect the reservoir with the city of Bologna. Further reservoirs of methane gas have been uncovered in the vicinity of Paullo in Modena Province. This yields 1,000 cu. ft. a day. The Italian government has removed restrictions on the import of machinery and apparatus for the extraction of methane gas, as well as all bans on the sale of the product.

BRITISH PUSH NEW CONSTRUCTION IN CHEMICAL INDUSTRY TO INCREASE EXPORT VOLUME

GOVERNMENT curbing of capital expenditure in industry has not greatly interfered with the progress of new construction and extension work under way, or even caused deferment of many expansion projects, in the chemical trades. Excess of demand over supply remains as urgent as ever and will induce the authorities to grant chemical production schemes priority when discrimination must be applied in the issue of industrial building projects. Latest reports from the provinces show no further delays have been experienced by chemicals makers in receipt of machinery and equipment, and as building work has progressed swiftly in the mild weather of the past few months, this spring and summer will bring substantial additions to Britain's chemical output capacity.

New plants, while adding to chemical production as a whole, will make fresh demands on the limited supply of certain key products. Recently manufacturers eager to introduce new articles have had to postpone their plans because of their inability to ensure a steady flow of raw materials. In the organic field in particular several new schemes depend on supplies of suitable intermediates becoming available. Establishment of a petroleum chemicals industry will help in the long run, but at present any further expansion in organic chemicals depends on the coal carbonization industry, and here prospects are not very promising.

The National Coal Board, responsible for Britain's nationalized coal mining industry, has hardly had time to study the matter. A director of

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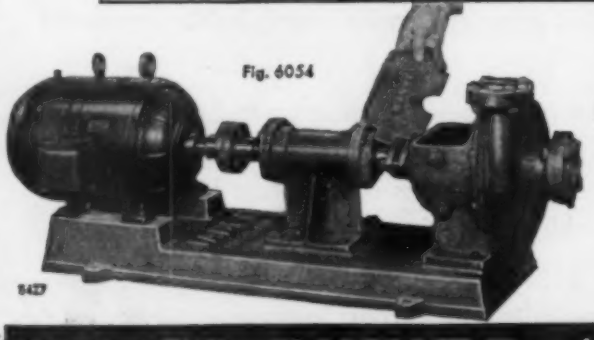

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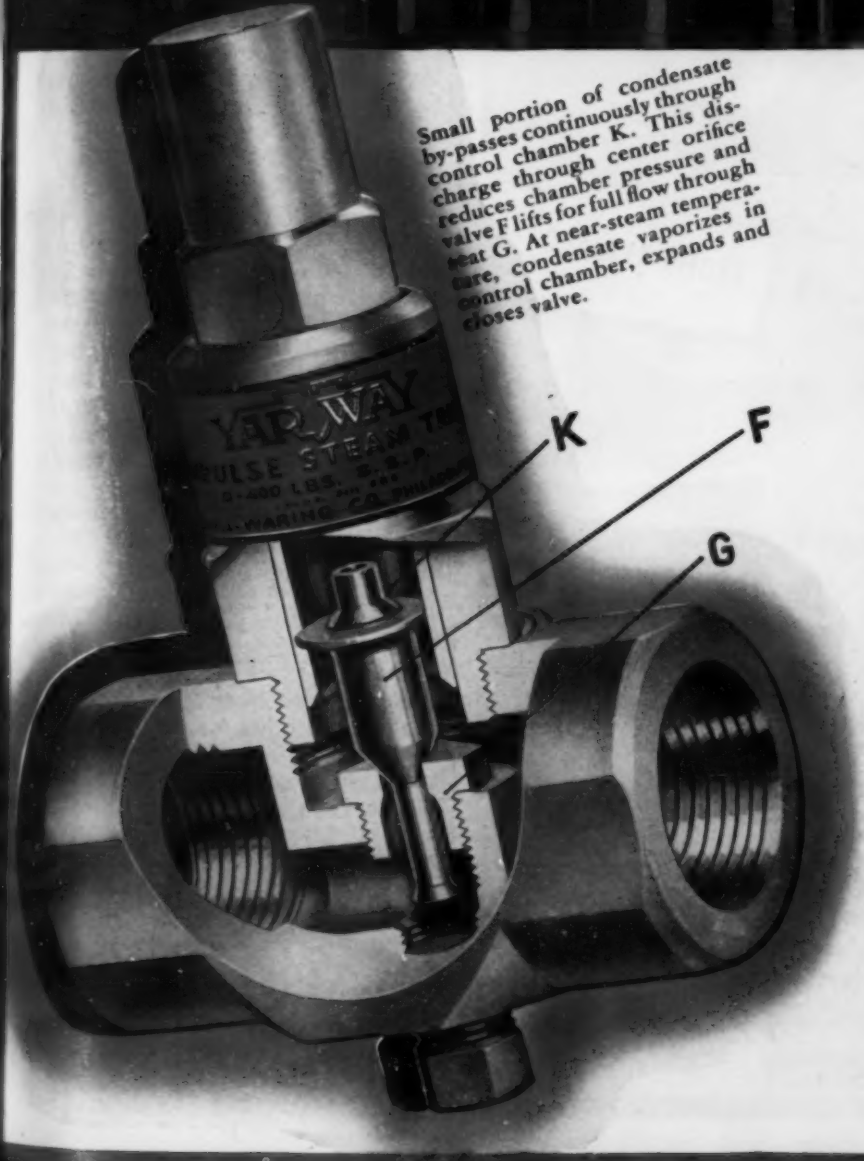

Small portion of condensate by-passes continuously through control chamber K. This discharge through center orifice reduces chamber pressure and valve F lifts for full flow through seat G. At near-steam temperature, condensate vaporizes in control chamber, expands and closes valve.

Six Yarway Impulse Steam Traps—doing a big job draining condensate from a battery of autoclaves used for experimental extraction of tanning materials. They are typical of the two hundred Yarway Traps installed on a variety of steam equipment at the big Eastern Regional Research Laboratory of the United States Department of Agriculture.

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carbonization was appointed last year, and a long-term modernization and expansion program is known to be under consideration. This year, however, no great increase in coke-oven throughout is anticipated, for such extensions as are carried out mainly serve to replace obsolete plant. The call for benzol, ammonia and coal tar is so urgent that great efforts will be made to improve recovery methods.

Soon the other big branch of the carbonization industry, the gasworks, will also be nationalized. The bill table in Parliament this month provides for the establishment of a Gas Council and 12 Area Gas Boards which in questions concerning coke production and marketing are to cooperate closely with their opposite numbers under the Coal Board. The State, through the National Coal Board and the Area Gas Boards, will thus soon be the only producer of high-temperature carbonization coke and byproducts. It will also undertake the production of certain chemicals, though only on a limited scale, in byproduct processing plants taken over in the course of nationalization. So much is certain, but from official statements it is also known that the Coal Board does not want to penetrate any farther yet into the chemical side of coal byproduct utilization.

Coal Chemicals Short

Meanwhile the supply position in this branch of the British chemical industry remains critical. No marked improvement in the supply of benzol, phenol or cresol is anticipated in the current year. Plastics manufacturers and others are now experimenting with diverse novel raw materials, and benzol users have appealed, though as yet unsuccessfully, for official help. Even in the field of coal tar products where the country normally has a surplus, changing conditions have made heavy inroads into the supply for exports. Last year coal tar, coal tar pitch and creosote oil were shipped abroad in larger quantities, but exports of benzol, cresylic acid, naphthalene and other tar products fell off steeply. The outlook for the new year is not any more hopeful. More phenol is likely to be required from the United States, although the U.S. product is much dearer than British phenol; meanwhile great efforts are being made to augment plant capacity for making synthetic phenol.

December statistics revealed an unexpected improvement in chemicals exports which for most products continued into the new year. The December total of £5,920,000 compares with £5,410,000 in November. The

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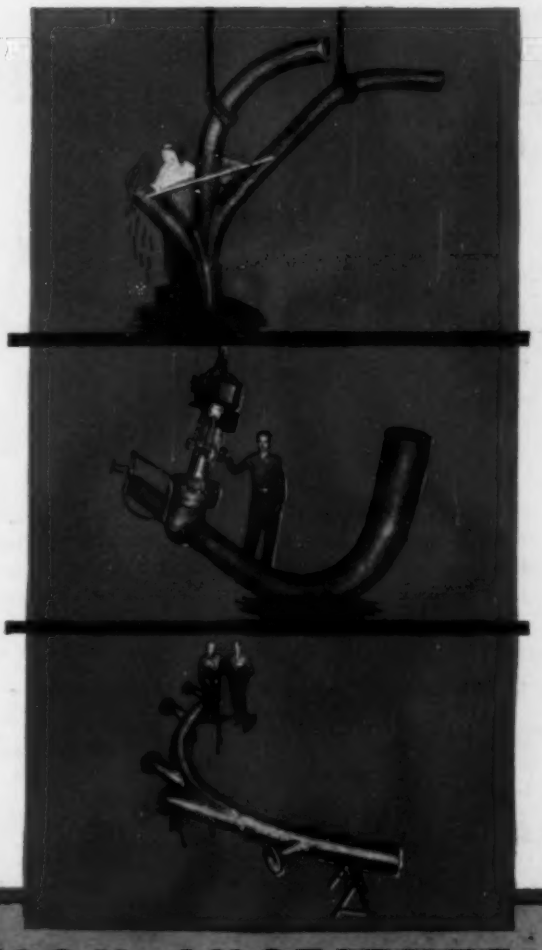

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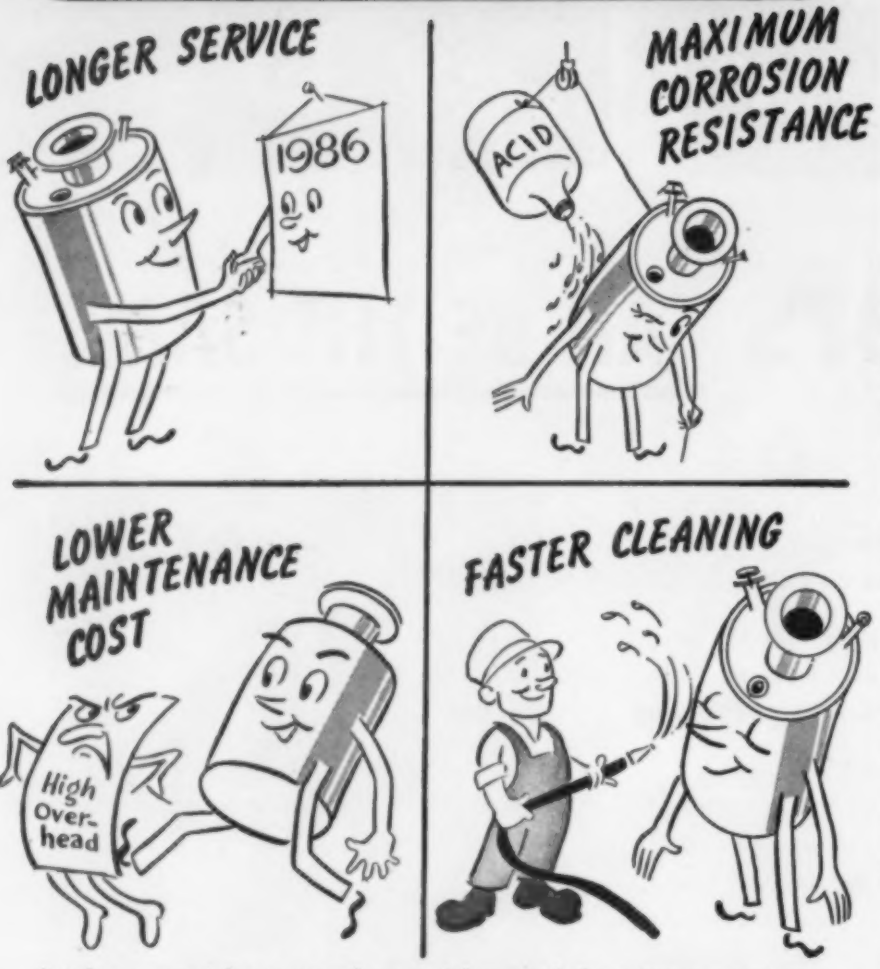

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improvement towards the close of the year had the result that the value of chemical exports in 1947, at £67,410,000, was slightly above the 1946 figure of £66,080,000. This slight improvement, however, was entirely due to higher prices. The export volume declined last year, largely owing to losses during the early months.

A detailed analysis shows that such important export articles as soda ash, caustic soda, bleaching powder, ammonium nitrate, other ammonium compounds (except sulphate), zinc oxide, lithopone, etc., reached little more than half the 1946 export figures. Benzol, naphthalene, white lead paste, copper sulphate, glycerine, calcium carbide, sodium silicate, chromate, nitrate and sulphate did even worse. There was indeed not one important basic chemical which materially gained on the preceding year's export figure. Considerable increases in sales abroad were recorded in the case of many specialized products and in manufactures with a high value: weight ratio, including dyestuffs, medicinal preparations and some but by no means all articles of the cosmetics group.

Export Targets High

Seen against the background of the high export targets for the chemical industry for this year, this analysis cannot but engender misgivings whether these targets can be achieved, especially if at the same time the direction of the export trade is to be shifted to hard-currency countries.

Imperial Chemical Industries Ltd. have released news of a new dyestuff, Alcian Blue 8GS, made from Monastral Fast Blue (copper phthalocyanine) by chloromethylation and subsequent interaction with a tertiary amine to give an "ionium" salt of copper methyl phthalocyanine. The new dyestuff gives bright turquoise shades not previously obtainable, possesses the fastness of vats, is water-soluble, and may be printed on silk, rayon, linen, chlorinated wool, nylon and paper. Until a new plant is built for Alcian dyestuffs, production will be dispersed over several existing I.C.I. factories; later a full range of new dyestuffs may be produced.

Turner and Newall Ltd., asbestos producers, will bring several new factories into production this year. At Hindley Green, priority will be given to the manufacture of rubber conveyor belting. More rubber V belting will be made in the new Ferodo factory at Chapel-en-le-Frith. Newhalls Insulation Co. is working on a new technique of thermal insulation applied to gas turbines. In the United

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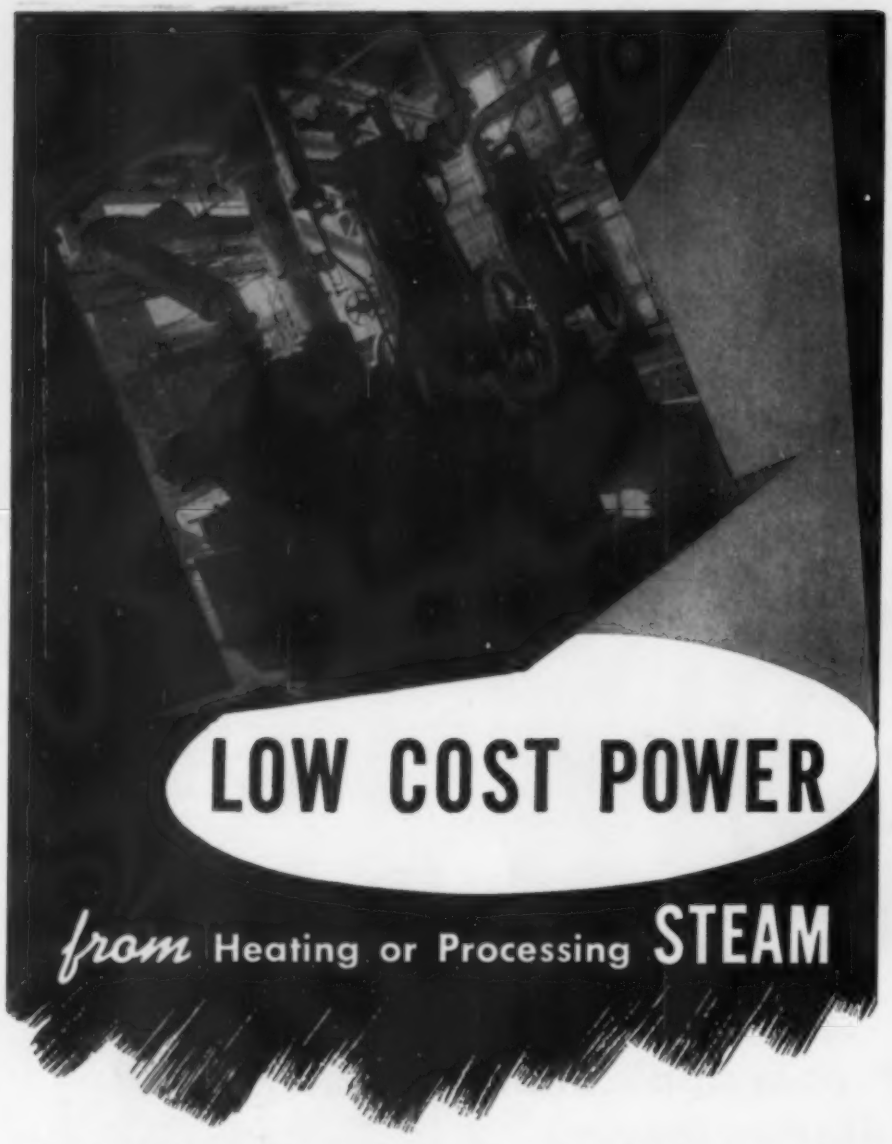

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States the new asbestos cement factory at New Orleans was brought into partial operation last year and will be in full production this year, and the Keasbey & Mattison factories at Ambler, Pa., and St. Louis have been working all out as far as raw materials permitted. In the new Canadian factory at Montreal, machinery is now being installed.

The first fermentation unit of the new antibiotics plant of Glaxo Laboratories Ltd., Ulverston, is scheduled to begin operations late in March. The same company is adding to its plant capacity at Barnard Castle.

Extraction of montan wax from lignite will begin this summer. British Lignite Products Ltd., which is exploiting the lignite deposits of the Bovey Tracey basin in Devonshire, also intends to produce a special type of activated carbon coke.

Shell Refining and Marketing Co. has taken over part of the Government wartime aviation spirit plant at Heysham, Lancashire, and intends to refine 1,500,000 tons of petroleum a year in this plant.

Permutit Co., Ltd., is commencing the production of ion-exchange synthetic resins at Pontyclun, South Wales, where the company has erected a new factory.

France Relaxes Controls On Most Chemicals

FRENCH chemical industry finds itself looking into a new year in which hardly anything seems certain. Prices, exports, labor, supplies of raw materials—prospects for all of these factors are currently shifting and more than usually unpredictable.

The price situation seems the most hopeful for the industry. After having labored for several years under government price controls which had allowed chemical raw materials to rise at a very much faster rate than prices of finished chemicals, the situation has finally been largely freed. This price squeeze had been more severe for the chemical industry than for any other. For example, last summer the official prices for chemical raw materials had reached 10.75 times the 1938 level, while finished chemicals sold officially at an average of four times the prewar price. The government began moving to relax the controls on some chemical prices last fall. But the real unleashing of the strait jacket came as a New Year's gift.

The Schuman middle-road government, as part of its general program of letting industrial prices move ahead in order to reach a balance with agricultural prices and allow industry to

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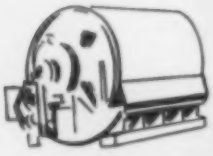

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meet higher wage costs, granted complete price freedom to all save a few basic chemicals. Ten of the basic chemicals still controlled in price had their prices raised to nine times the 1939 level by the new decree, including such items at nitric, hydrochloric and acetic acids, sodium chlorate and aniline.* Twenty three others including sulphuric acid and fertilizers were not affected by this decree, but it was expected their prices would shortly be raised though still kept under control. Apart from these 33 basic products, the whole range of chemical output (including also such fields as paints, varnishes, inks, soaps) was freed from government price control.

It is still too early to say at what level the new free prices will settle. Year-end wage rises, which the government estimates at about 25 percent but which industry leaders say will work out above this figure, ensure a considerable jump above previous price levels. The labor picture also continues clouded, as the Communist leadership of the chief union in the industry is still in power, though threatened by new rivals. Production, however, has jumped back since the November-December strikes.

* As an indication of what some of these new prices are, one may cite nitric acid, 36 deg. Be, tank car lots, at about 4.8 c. per lb., and hydrochloric acid, 20-21 deg. Be, tank car lots, at about 2.4 c.

New Pulp and Paper Mills Going Up in Australia

PRODUCTION of newsprint from Australian hardwood pulp started in 1941 with the establishment of a plant on the Derwent River, near Hobart, Tasmania, by metropolitan newspaper publishers. The pulp is produced mechanically from indiginous eucalyptus, hardwood, with 20 to 22 percent of Canadian sulphite pulp added for improved strength. The plant has a rated capacity of 540 tons of newsprint a week.

Another mill has been operating at Burnie, Tasmania, since 1938, producing caustic soda for cooking, and chlorine for bleaching, in an adjacent electrolytic unit. Its two paper machines produce a wide range of high class printing paper, as well as writing, drawing, duplicating and blotting paper. In Victoria, a pulp plant with an annual capacity of 27,000 tons of kraft pulp, also produced from local hardwoods, swung into production in 1939 at Maryvale. In South Australia, a pulp and paper board mill opened up in 1942 near Millicent. It is the only mill in Australia that can rely on ample supplies of softwood and does not have to contend with the cellulose chemistry problems that

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as you want it!

STAINLESS OR ALLOY
TUBING
STRAIGHT or FORMED

There is a wide range of steel tubes in this warehouse for you—as you want it and when you want it—from stock. Stainless and Heat Resisting tubes. Seamless steel pressure tubing. Boiler and pressure tubes—in many sizes and types, and finishes.

Tubes may be bent, swaged, expanded, upset, studded, etc. or otherwise formed to your requirements in our own shops on short notice.

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THERE'S A RIGHT WAY TO MIX IT

NETTCO
AGITATING
EQUIPMENT

Every industry has its own particular agitating problems — and its unique mixing methods. NETTCO Agitators are engineered for specific jobs to operate at maximum efficiency — mixing a wide range of liquids or combinations of liquids and dry materials. In the last forty years, thousands of difficult blending and mixing problems in many industries have been successfully solved by NETTCO specialized agitating equipment. NETTCO standardized parts and units, designed to combine economically, provide highly specialized mixers at low cost to improve the efficiency of process operations. We regularly furnish agitators in ratios from 1 to 2,000 and speeds from ½ to 1750 R.P.M. to satisfy your particular requirements.

Model TAB Agitator Drive

Write for Catalog

NEW ENGLAND TANK & TOWER CO.
87 TILESTON ST., EVERETT 49, MASS.

are linked with use of eucalyptus pulpwood.

Employment in the paper industry has soared from 2,000 in 1939 to 5,000 this year, and production is ticking over at the rate of 100,000 tons of paper and newsprint and 70,000 tons of paper board a year. Most important, pulp output has jumped from 6,200 tons in 1938-39 to 85,000 tons a year.

Construction of additional sawmills, pulp plants and paper machines is going ahead under contracts signed before imports of equipment from North America had to be called off. Australian Newsprint Mills, the newspaper-controlled outfit, has plant on order to boost pulp output from 30,000 to 80,000 tons a year. However, the full capacity will not be in operation before 1950. Associated Pulp & Paper Mills hopes to run in a third paper machine in Tasmania early in 1948, and delivery of a fourth unit is promised for late in 1949.

Australian Paper Manufacturers Limited, the pioneer paper concern, has sent a mission to Europe and North America to investigate the supply position for new plant. Thomas Owen & Co., the British paper firm, is floating an Australian subsidiary with a capital of £2,000,000 to produce fine writing paper in a former munitions plant near Ballarat, Victoria. Plant will arrive from England early in 1948.

Russia Uses Plywood In Making Footwear

PROSPECT of economizing three to five million hides annually is forecast for a new Soviet-developed leather substitute, identified as "Fanerol," a chemically-treated plywood suitable for making shoe inner soles and counters.

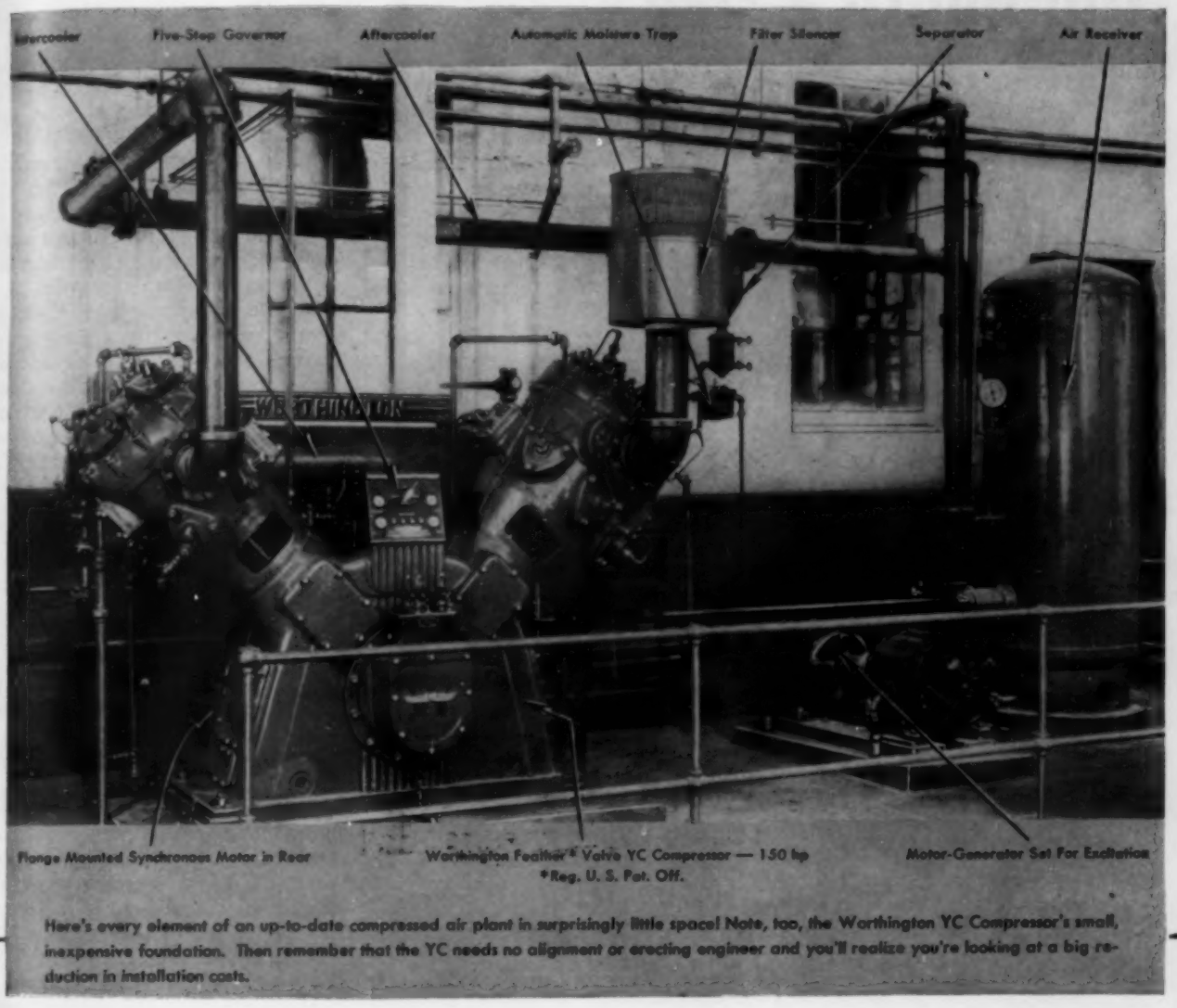
Developed at the Central Shoe Leather Research Laboratory of the Soviet Producers Cooperative Society, "Fanerol" is stated to approximate leather in wear-resistance, elasticity and hygienic qualities. Its inventor A. Levigurovich, a shoemaker by trade, spent four years developing a process for making the wood-base material elastic. Both laboratory and performance tests have shown the new material to be a satisfactory leather substitute.

France Pushes Research On Atomic Energy

FRANCE is well-equipped with top-flight atomic physicists but has had to start largely from scratch in assembling equipment and uranium needed to develop and experiment with

WORTHINGTON ALL THE WAY!

A Modern, Efficient Compressed Air Plant...Engineered Entirely By Worthington



*Reg. U. S. Pat. Off.

Here's every element of an up-to-date compressed air plant in surprisingly little space! Note, too, the Worthington YC Compressor's small, inexpensive foundation. Then remember that the YC needs no alignment or erecting engineer and you'll realize you're looking at a big reduction in installation costs.

Plus HIDDEN Advantages Like These:

Power factor improvement from the synchronous motor and quick-acting, 5-step governor . . . completely automatic control for the entire system, as in the largest compressed air plants . . . advanced YC design that assures a longer-lived, cooler and smoother running compressor, with maintenance and operating expenses at their lowest.

Write for further facts that prove *there's more worth in Worthington.* Bulletin L-667-B1A tells the complete story of how YC Compressors can cut your air costs. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

K7-18

WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

*Reg. U. S. Pat.

Complete *Your* process-picture

with

VIRGINIA

$Na_2S_2O_4$

SODIUM HYDROSULPHITE

"Virginia" Sodium Hydrosulphite is a concentrated, white, stable, free-flowing, uniformly crystalline powder, readily soluble in water. Its powerful action will reduce solutions of the salts of selenium, tellurium, arsenic, antimony, bismuth, silver, gold, copper, chromium, and mercury. It is widely used in the bleaching of soaps, sugars, oils, minerals, straw, and various fibres. Shipped in 250 lb. steel drums.

Perhaps "Virginia" $Na_2S_2O_4$ can perform some important function in improving your processes. Let us help you in adapting it . . . there's no obligation. VIRGINIA SMELTING COMPANY, West Norfolk, Virginia.

Established 1898

VIRGINIA *Chemicals*

SULFUR DIOXIDE
SODIUM HYDRO-SULPHITE • ZINC HYDROSULPHITE
ZINC SULFATE

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atomic energy. The government created in 1945 a Commissariat for Atomic Energy and put at its head the atomic physicist Frederic Joliot-Curie, a member of the French Communist party. This year's budget for the Commissariat is about $7,000,000 and the program calls for completion by the end of next year of a small atomic pile using heavy water as a slowing agent, and of a considerably larger pile using graphite as soon as possible thereafter.

Dr. Kowarski, head of the Commissariat's scientific services, says the main aim at present is to get enough people acquanted with the phenomena of nuclear fission. First point is the search for uranium. Sixty-eight prospectors, many of them young fellows taken from the "maquis" resistance movement, have been trained, equipped with electromagnetic detectors, and sent forth on the search throughout France and its territories. Three small new deposits have been found in France near Autun and their exploitation is under way. These deposits, however, and the larger ones in Madagascar, have much lower yields than the Belgian Congo's rich mines.

Secondly, part of the French state gunpowder factory at Le Bouchet near Paris has been turned over to the refining of uranium. In the old fort of Chatillon, built in the last century to guard Paris, the Comissariat has created a cluster of shops to make prospecting and other apparatus; chemical and mineralogical laboratories; and in the fort's stone casemates, an installation for atomic experiments. About 200 people are now employed in these activities at the fort of Chatillon. A new atomic city, including factory and workers' houses, is planned for the desolate plateau of Saclay about twelve miles from Paris. But construction of this larger installation has not yet begun and is not scheduled for completion for five or six years.

Meanwhile theoretical work continues in such laboratories as those of the College de France, the Institut de Radium and the Centre National de Recherche Scientifique. The Commissariat has also placed parts orders for a new 60-in. cyclotron.

Australian Company Will Produce White Lead

A COMPANY has been established at Melbourne, Australia, to exploit the Euston white lead process under license to the Glidden Co., Cleveland, Ohio. It has been registered as Euston Lead Co. (Aust.) Ltd. with a nominal capital of £500,000. The company will manufacture white lead by the

CENTRIFUGAL PUMPS FOR EVERY SERVICE

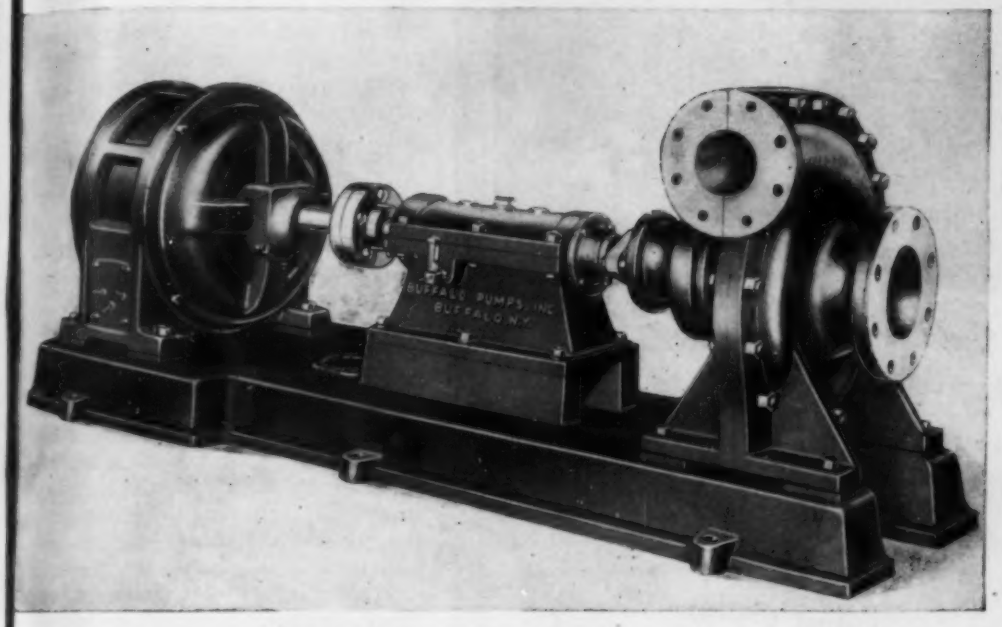
This pump LIKES

√CONCENTRATED HYDROCHLORIC

√ CHLORINATED SOLUTIONS

√OTHER CORROSIVE LIQUIDS

PUMPS by "Buffalo"



Buffalo Rubber-Lined Single Suction Pump

IT'S *Rubber-Lined* FOR *Long Range Service*

RUBBER covers every internal part exposed to liquid! Here's long, economical, trouble-free pumping for some of the most corrosive chemicals. Hard or medium rubber is supplied, according to the liquid. Shaft sleeve, stuffing box bushing, impeller lock nut and other parts are Hastelloy "C". And these pumps have all the typical "Buffalo" quality of workmanship and materials that means MORE PUMPING FOR YOUR MONEY on a long-range basis.

Do you have a corrosive liquid pumping problem? There's a "Buffalo" Pump with the *right* design, the *right* capacity and *right* construction for you. We're ready to help you. Simply write:

BUFFALO PUMPS, INC.

501 BROADWAY BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

For

- WATER ANY TEMPERATURE
- PAPER STOCKS (NON-CLOGGING)
- GENERAL SERVICE
- ACIDS
- ALKALIS
- SLURRY
- CONDENSATE RETURN
- SUMP CLEARANCE
- FIRE SERVICE
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RUGGED, PRECISION CONSTRUCTION—FOR LONG LIFE

DINGS *High Intensity* Double Gap Rectangular Spout Magnet Removes 3 Hazards:

1 Prevents tramp iron damage to processing equipment

2 Frees your products from tramp iron contamination

3 Prevents fires and dust explosions

• You'll get *maximum* protection with this *electromagnet* because it is the most powerful magnet available. *High Intensity Double Gap* magnetic field extracts tramp iron at distances up to 12" from magnet face . . . more than any other magnet! Simple to install . . . tramp iron caught and held securely . . . trouble-free—no moving parts . . . negligible current consumption . . . complete range of sizes. No matter what your job Dings has the best magnet for the purpose, either *electro* or *permanent*. Write today for full details in Cat. 301A.

Also Available with Automatic Safety Gate...

Gate opens automatically when current is interrupted, discharging tramp iron. Prevents iron from going down chute in event of current interruption and makes iron removal easy.

DINGS MAGNETIC SEPARATOR CO.

4730 West McGeogh Avenue — Milwaukee 14, Wisconsin

Dings "HIGH INTENSITY"

Separation Headquarters Since 1899

Euston precipitation process. A plant with an initial capacity of 7,000 tons a year is going up at Somerville Road, Braybrook, Vic.

New Zealand Expands Its Chemical Industry

ESTABLISHMENT of a seaweed industry for the manufacture of algenic acid products from Foveaux Strait kelp is being considered by a company that has been formed in Christchurch. The company will operate from Stewart Island. Sodium algenate is in demand as an ingredient for foodstuffs and also in the cosmetics industry.

The linseed oil manufacturing industry is being rapidly expanded to meet the worldwide shortage. The industry was started about four years ago and has made steady progress.

New Zealand Forest Products Ltd. is floating a debenture issue of £1.25 million in Australia to provide capital for various timber processing activities. These include erection of a kraft pulp mill with an annual capacity of 10,000 tons, to be followed by a kraft paper mill. Pending construction of the paper mill, about half the pulp output will be shipped to Australia.

Production of coal, town gas and superphosphate fertilizer in the dominion for the first nine months of 1947 set a new postwar record.

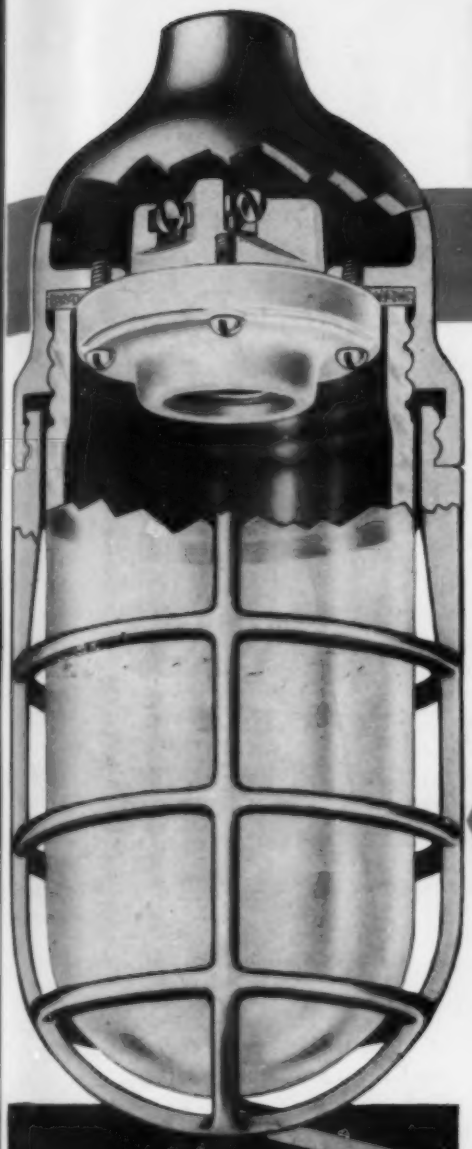
South Africa Reorganizes Paperboard Company

SOUTH AFRICA'S major paperboard company has been reorganized to expand its output from 30 to more than a hundred tons a day. The former National Pulp and Paper Co. in conjunction with the British Coated Board and Paper Mills, Ltd., of England has put up £500,000 to capitalize the new South Africa Board Mills, Ltd. The factory at Umgeni in Durban is the former National Pulp and Paper Co. plant.

Manioc Alcohol Made by Brazilian Distillers

FIVE large distilleries in Brazil are now producing alcohol from manioc, according to an announcement from the Executive Commission on Manioc Products of the Brazilian Ministry of Agriculture. About 4 million liters of manioc alcohol will be produced this year and in 1948 the volume is expected to rise to more than 22 million liters. The product is said to be a perfect substitute for grain alcohol. Dr. Diogenes Caldes, Rio de Janeiro, is president of the Executive Commission.

Vaportight
Industrial Lighting
CONDULET*



For use in boiler rooms, powerhouses, shower rooms, tunnels, loading docks, building entrances, and all indoor and outdoor locations where exposed to moisture and rain, non-explosive vapors and gases, or non-combustible dusts.

Vaportight and raintight.

Wiring chamber remains vaportight even though globe is off.

Porcelain Receptacle.

Screw guard or clamp guard.

11 Hub arrangements.

4 Reflector styles.

Accessories: Colored globes, pear-shaped globes and guards, half shades, and adapters.

4 Sizes: 50 through 500-Watt.

Vaportight **lighting fixtures are available for attaching to several round-base Condulets and sheet steel outlet boxes. Crouse-Hinds complete *Vaportight* line includes hand lamps, switches, plug receptacles, and other electrical devices.**

Complete listings in Section 25, Condulet Catalog 2500.

* **CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.**

A Nationwide Distribution Through Electrical Wholesalers

CONDULETS
FLOODLIGHTS
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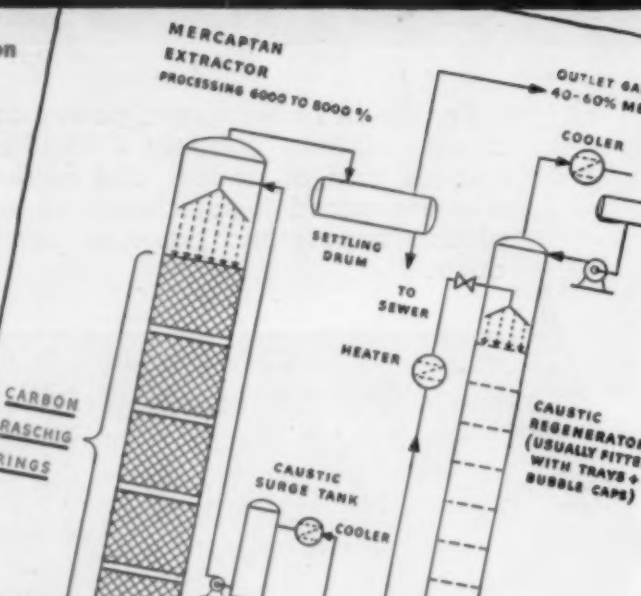
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

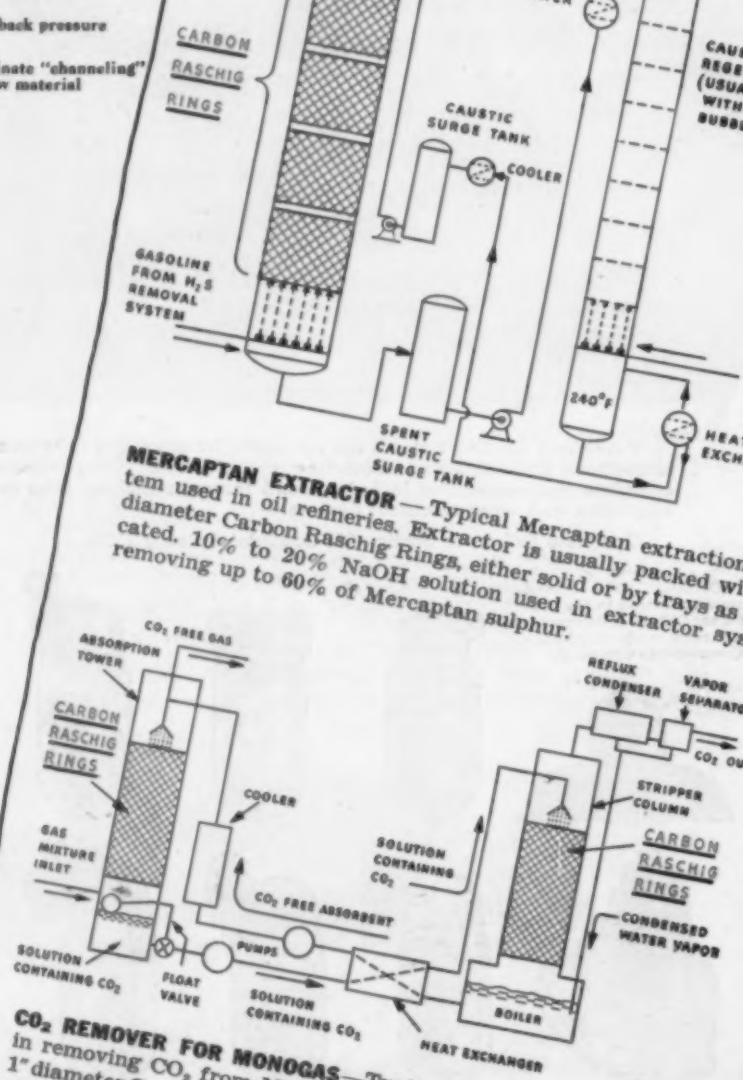
Pack your towers...with CARBON Raschig Rings!

Advantages of Carbon Raschig Rings

- Corrosion resistant
- Light in weight
- Immune to thermal shock
- Won't crush in the tower
- Minimum of chipping and spalling
- More contact surface
- Low back pressure
- Eliminate "channeling" of flow material



MERCAPTAN EXTRACTOR—Typical Mercaptan extraction system used in oil refineries. Extractor is usually packed with 1" diameter Carbon Raschig Rings, either solid or by trays as indicated. 10% to 20% NaOH solution used in extractor system removing up to 60% of Mercaptan sulphur.



CO_2 REMOVER FOR MONOGAS—Typical extraction system used in removing CO_2 from Monogas. Both towers are packed with 1" diameter Carbon Raschig Rings for maximum contact surface, absence of "channeling," and minimum back pressure. Carbon Raschig Rings are suitable to a wide range of tower-packing jobs.

For more information, write to:
NATIONAL CARBON COMPANY, INC., Dept.

● "National" "Kempruf" Carbon Raschig Rings provide the most economical and efficient tower-packing material for reaction and scrubbing towers handling corrosive agents, such as hydrofluoric acid, organic-hydrochloric mixtures, and hot aqueous alkalies. These rings are also excellent in extraction systems . . . towers in which sudden temperature changes result in severe thermal shocks . . . rectifying towers . . . and tower processes where thorough dispersion is essential to satisfactory operation.

The terms "National" and "Kempruf" are registered trade-marks of
NATIONAL CARBON COMPANY, INC.
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30 East 42nd Street, New York 17, N. Y.
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THE CORROSION FORUM

Edmond C. Fetter, ASSISTANT EDITOR

Nitric Acid Versus Construction Materials

Part II of a symposium in which typical materials of construction are evaluated for services involving nitric acid. Part III will appear next month.

CARBON and GRAPHITE

W. M. GAYLORD
National Carbon Co.
Cleveland, Ohio

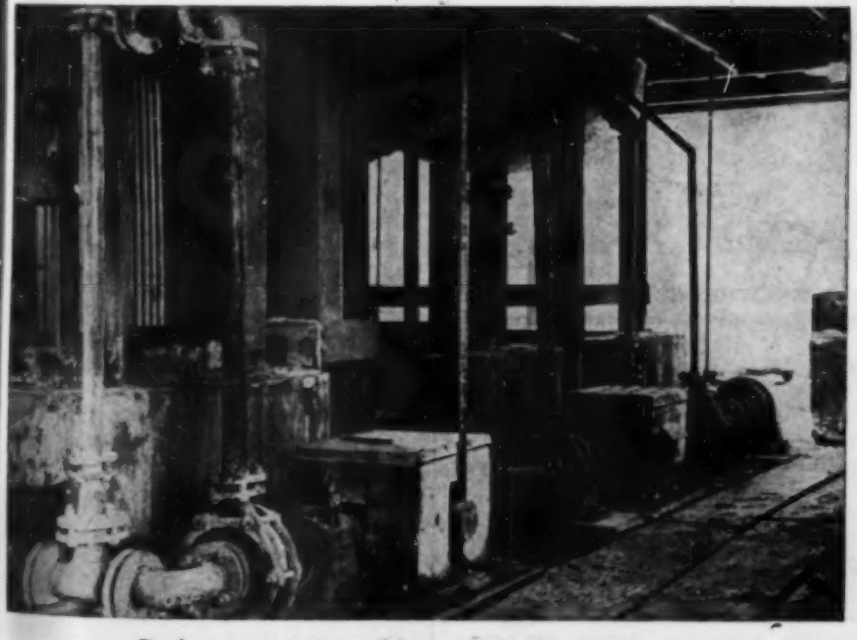
NITRIC ACID is one of the few chemicals to which the corrosion resistance of carbon in its various forms varies markedly. For example, the diamond is unattacked by nitric acid in all concentrations. As the crystal structure proceeds through the non-graphitic to graphitic stages varying degrees of reaction may occur ranging from almost insignificant oxidation of non-graphitic grades in dilute nitric solutions to physical expansion and structural failure of graphite in fuming nitric acid.

Because of these considerations, nongraphitic (amorphous) carbon is generally preferred for nitric acid conditions where heat transfer is not a problem. Its most widespread use is in mixtures of nitric acid with other highly corrosive materials of a non-oxidizing character. Carbon bricks, for example, are accepted as standard construction for tank linings in the pickling of stainless steel in solutions generally ranging from 10-14 percent HNO_3 with 2-4 percent HF. Such linings have been in service for 14 years with no apparent evidence of brick deterioration.

Where heat transfer is involved, Karbate impervious graphite is used successfully. While slow progressive attack may be expected on the impregnating resins used to fill the natural pores, life of several years has been obtained on Karbate equipment operating in solutions containing 10 and 40 percent HNO_3 at 185 deg. F. and 140 deg. F., respectively.

Carbon brick and Karbate heaters are commonly used, as here, in pickling tanks for stainless steel.

Karbate plate heat exchangers have been in service in stainless pickling operations since 1942 with practically no maintenance.



Duriron pumps, pipe and fittings in service for 20 years circulating nitric acid in the manufacture of arsenic acid.

HIGH-SILICON IRON

WALTER A. LUCE
The Duriron Co., Inc.
Dayton, Ohio.

NITRIC ACID and many solutions containing nitric acid have been successfully handled by the high-silicon irons for a number of decades. The excellent resistance of high-silicon iron to the strong, active acids such as nitric and sulphuric has long been recognized by corrosion engineers. Its susceptibility to thermal and mechanical shock, however, has somewhat limited its use; but abnormally high temperatures are constantly being handled when proper care is exercised. This alloy is also relatively inexpensive compared to other corrosion resistant materials employed for acid services.

The high-silicon iron, Duriron, has

SIER-BATH GEAREX PUMPS
—no pulse, but very much alive!

SIER-BATH GEAREX PUMPS are sturdy positive displacement units that discharge liquid without pulse or vibration. This is accomplished by means of double helical pumping rotors and discharge passages of proper area to insure continuous overlapping displacement of liquid. The rotors are not in contact, thus reducing wear and increasing life. If you are interested in pumping efficiency with low maintenance costs, write us for booklet.

SIER-BATH GEAREX PUMP

Balanced axial thrust • Vibrationless operation • Roller bushings for precision running under load.
Pumps: Oils, varnishes, solvents, molasses, chemical solutions
Capacities: 1-550 g.p.m.
Discharge: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.

● The two Sier-Bath Gearex Pumps shown are installed in the boiler house of Metakloth Company, Lodi, New Jersey. They pump Bunker C fuel oil to the boiler at a pressure of 60 lbs. The user expresses complete satisfaction with the installation which was made in December 1946.

★

For higher pressures and capacities

use

SIER-BATH SCREW PUMPS

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

9259 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

a nominal chemical composition of 14.5 percent Si, 0.75 Mn and 0.90 C max. It is supplied in the cast form only and due to its extreme hardness can be machined only by grinding methods. The high silicon content results in an alloy with low tensile strength and high compression strength, therefore, the design of Duriron equipment keeps stresses in compression whenever possible. The types of chemical equipment which can be supplied in Duriron include pumps, valves, heat exchangers, heaters, jets, fans, ejectors, pipe and others.

Duriron is unattacked by all concentrations of nitric acid at normal temperatures. Increasing the temperature has very little effect on its corrosion resistance. Boiling nitric acid at concentrations above 50 percent has no effect on Duriron, although weak solutions do show a very slight attack.

The resistance of Duriron to nitric acid solutions containing other constituents depends entirely on its resistance to these other constituents. Therefore, nitric acid solutions containing hydrofluoric acid, fluorides, sulphurous acid, or one of the few other corrosives for which Duriron is not recommended may cause excessive corrosion.

A few examples showing various nitric acid applications to which Duriron equipment has given excellent service are cited as follows:

1. Many chemical plants use Duriron equipment in the production of nitric acid by the sodium nitrate-sulphuric acid method. They use complete Durion installations including denitrators, towers, condensers, pipe, and valves. Duriron gives long, trouble-free service.

2. In plants making nitric acid by the ammonia-oxidation process Duriron equipment is used extensively in the form of pipe, condensors, pumps, valves, tank outlets, towers, packing (Raschig rings) and fans. Excellent service is again obtained.

3. One chemical plant is using Duriron equipment on all concentrations of nitric acid at various temperatures including strong nitric at a very high temperature. They have not found any nitric acid condition for which Duriron is not suitable.

4. Many fertilizer plants use Duriron valves for handling nitrate solutions since they are more economical than iron based on a number of years experience.

Since no advantage in nitric acid is obtained by using the special high-silicon iron, Durichlor, no mention has been made of this alloy. Durichlor contains 3 percent Mo in addition to the constituents in Duriron. Its prin-

announcing:

NOW AVAILABLE IN ROLLED FORM

The Carpenter Steel Co., of Reading, Pa., through an exclusive licensing agreement, is producing bars, rods, flats, strip and wire. The bar, rods, wire and hexagons are stocked in the popular sizes, with billets on hand for fast delivery of special sizes. These are being sold by The Duriron Co. under our trade name ***Durimet 20*** and by Carpenter Steel Co. under their trade name ***Carpenter Stainless Steel 20.***

Welded tubing is also available, ⅜" to 2⅜" OD and standard IPS up to 2", and sold exclusively by the Carpenter Steel Co., Union, N. J., under their trade name Carpenter Stainless Steel 20. *However, Durco Engineers and Metallurgists are anxious to help work with you on the proper application of this tubing. We ask you to call us in for consultation.*

NOW MORE READILY AVAILABLE IN CASTINGS—

The demand for this alloy became so great that the Duriron Co. licensed other foundries to produce castings. Licenses have been issued to the following:

FOUNDRIES	TRADE NAME
Electric Steel Foundry Co.	ESCO 20
Lebanon Steel Foundry Co.	CIRCLE L 34-20
Michigan Steel Castings Co.	MISCO 20
Utility Electric Steel Foundry	UTILLOY 20

Note: Castings made in these foundries are under the broad scope of our patents, which could cover a great many analyses other than that given above for Durimet 20. To make certain that you receive the Durimet 20 analysis, it should be specified as shown above or "to the analysis of Durimet 20". The numeral "20", however, is being used by the above foundries to designate the Durimet 20 analysis.

NOW YOU CAN SOLVE SOME OF THOSE TOUGH CORROSION RESISTING EQUIPMENT PROBLEMS

The availability of both castings and rolled forms of this superior stainless steel makes it possible for process engineers to procure equipment requiring both forms for tough services like these:

SULFURIC ACID — Durimet 20 highly resistant to most concentrations up to 80° C. (176° F.) and up to 10% at boiling temperature. Fair resistance to hot 78% acid.

OXALIC ACID — Durimet 20 more resistant than 18-8S and 18-8SMo at all concentrations and temperatures.

MERCURIC SULFATE — Durimet 20 greatly superior to 18-8S and 18-8SMo due to presence of sulfuric acid in manufacture.

NITRIC ACID — Durimet 20 is highly resistant at all temperatures and concentrations. Substantially superior to 18-8S and 18-8SMo at higher temperatures and when certain impurities are present.

A DURCO SUPER STAINLESS STEEL FOR TOUGHER CHEMICAL CORROSION SERVICE

NOMINAL COMPOSITION

	Cast	Wrought
Nickel	29.00%	29.00%
Chromium	20.00%	20.00%
Molybdenum	1.75% Min.	2.00% Min.
Copper	3.50% Min.	3.00% Min.
Silicon	1.00%	1.00%
Carbon	0.07% Max.	0.07% Max.

DURCO Adv. 55-GM

DURCO — CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON CO., INC.
DAYTON 1, OHIO
Branch Offices in Principal Cities

THE DURIRON CO., Inc.
Dayton 1, Ohio

Send us your new Bulletin 112 on Durimet 20, the patented alloy that you have developed through A to Z and 1 to 20, since 1929. I want especially to know where it is recommended over the ordinary stainless steels.

NAME_____

FIRM_____

ADDRESS_____

CITY_____

Crimpy
The Buffalo Wire Cloth Man
Gets Tinned!
I PUT ON A COAT OF TIN
. . . right over my steel wire before I'm woven, to take on separating, sorting and cleaning jobs with flour, chemicals, powders, seeds and foods.
BRING ON THE FOOD! I'M NON-CONTAMINATING
My coating is pure tin . . . and smooth as silk. Oh, that's not all! I resist humidity . . .
BUT MY MIND ISN'T ALWAYS ON FOOD!
I'm fast . . . can take quite a bit of abrasion, as you can see!
PEOPLE FIND ME EASY TO WORK WITH!
Want to form me? Go ahead! Easy? You bet- unroll me and I'm always flat and straight- don't draw like other cloths.
I'M ATTRACTIVE PRICE-WISE TOO!
I've the economy of steel with only the small difference for my tin coating. But it's that coating which improves separation by filling my pores!
"BUFFALO" TINNED WIRE CLOTH
Woven in a large range of square meshes; available in rolls or cut pieces; made into reel covers; furnished with hook strips or webbing.
Buffalo WIRE WORKS CO., INC.
Manufacturer of All Kinds of Wire Cloth Since 1869

cipal uses are in hydrochloric acid and chloride services.

STAINLESS STEEL

GRANT L. SNAIR, Jr.
Allegheny Ludlum Steel Corp.
Brackenridge, Pa.

STAINLESS steel grades in both the 400 series (straight chromium) and 300 series (chromium-nickel) are very resistant to all concentrations of nitric acid at practically all temperatures. They are used for chemical processing equipment such as storage tanks, reaction vessels, condensers, and screens. The successful development of the ammonia oxidation process, now the chief method for the manufacture of nitric acid in the United States, was based upon the corrosion resistance of stainless steel which is used extensively throughout the system, especially in the absorption towers. Additional common applications are heat exchangers, valves, pumps, and pipe lines. Similar equipment is practically indispensable in the production of dyestuffs, high power explosives, artificial silk, and in the numerous other industries which depend wholly or in part on the satisfactory handling of nitric acid.

Where nitric acid solutions of any concentration are involved at room temperature, all of the stainless steel grades exhibit satisfactory corrosion resistance, and selection of material is determined by physical requirements. The better ductility or weldability of the chromium-nickel grades is often desirable. As the service conditions become more severe with increasing temperature or concentration, the high chromium-nickel grades may be superior to the lower alloy grades such as Type 410 containing only 12 percent chromium. The straight chromium grades containing at least 17 percent chromium and all of the chromium-nickel grades are highly resistant to 50 percent nitric acid at the boiling temperature.

Molybdenum additions, as found in Types 316 and 317, do not improve the resistance to nitric acid corrosion. In some instances, Types 316 and 317 are less resistant than the regular 18-8 grades. Types 309 and 310 are especially well suited for service at high temperatures and pressures, and these grades with or without columbium.

The standard nitric acid corrosion test which is well known and accepted as one of the most dependable methods for laboratory testing and evaluating the corrosion resistance of stainless steel provides a good indication of the performance that can be expected under severe operating conditions. Average typical corrosion rates for the

1 300 B.C.—Crude elevators like this helped primitive farmers store grain in bins above ground. Hand operation was the rule though animal power, even water wheels, were used.

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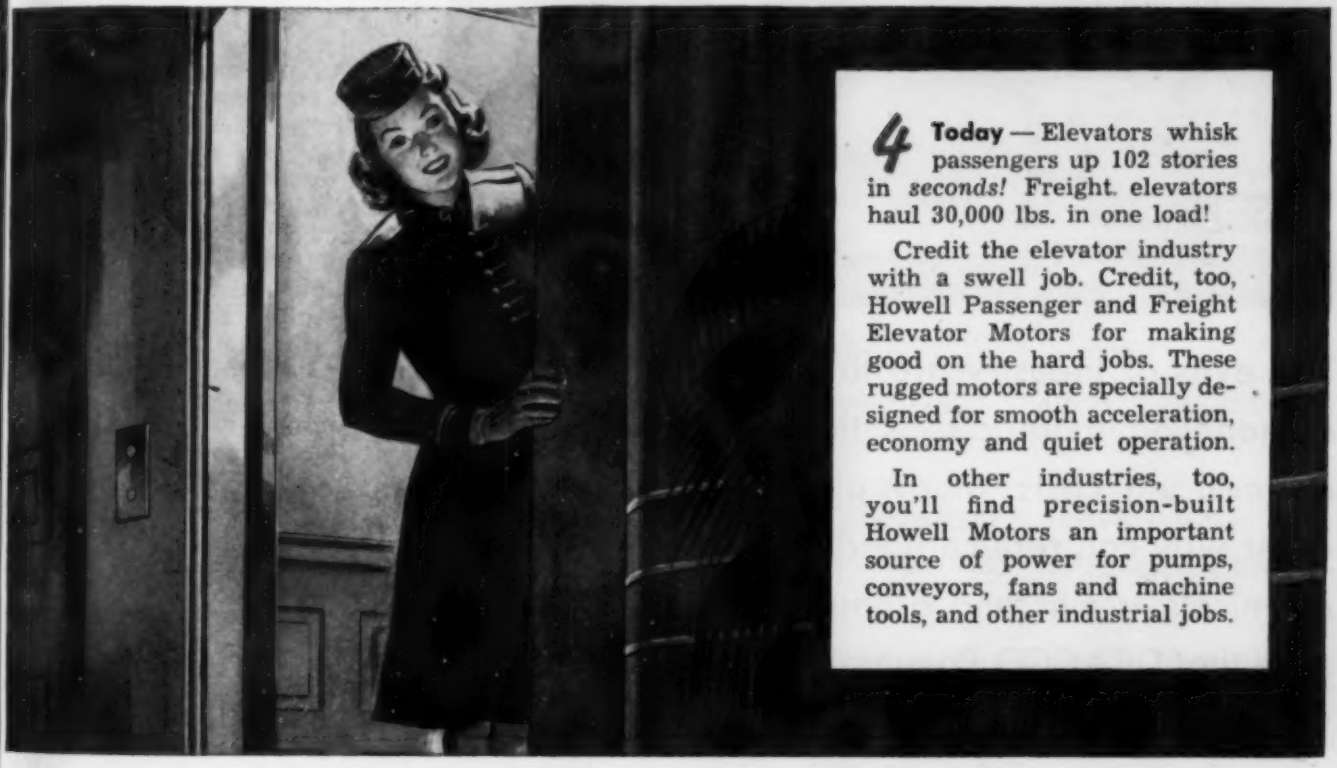

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various superior grades immersed in boiling 65 percent c. p. nitric acid solution (sp. gr. 1.398) for five periods of 48 hr. each are shown below. New acid is used for each period of the test.

Type	Corrosion Rate, Mils Per Year
430	< 60
304	< 12
347	9.6-14.4
308	< 12
309	< 12
309 Cb	4.8-8.4
310	< 12

< = less than

The unmodified chromium-nickel steels which contain precipitated carbides resulting from heating too long in the 800-1,500 deg. F. temperature range are subject to intergranular corrosion in the presence of nitric acid. Types 347, 309Cb, and 310Cb contain columbium additions which prevent harmful carbide precipitation. These grades must be used if heavy welded sections are required or if large units are stress relieved after fabrication. Type 347 is satisfactory for temperatures below the boiling point, while Types 309Cb and 310Cb are better suited for temperatures above the boiling point.

Considerable attention recently has been given to stainless steel chambers for fuming nitric acid used in rockets. Laboratory tests have shown that stainless steel offers good resistance to fuming nitric acid liquid and vapors at room temperature. This is one of the most severe intergranular corrosion agents known. Field experience does not always correspond with the results of laboratory tests, probably because high pressure and stresses which cannot be duplicated in the laboratory are often involved in service conditions in the field.

Various mixed acid solutions containing nitric acid are safely handled in stainless steel equipment. Nitric-sulphuric acid mixtures of many concentrations are commonly used in contact with Types 430, 446, 304, and 347. Also, certain mixtures of phosphoric, acetic, or other acids with nitric acid do not attack stainless steel. Mixtures of nitric acid with either hydrochloric or hydrofluoric acid are corrosive to all of the stainless steel grades, the extent of attack depending upon the acid concentrations and the solution temperatures. Nitric-hydrofluoric acid baths are regularly used for descaling stainless steel.

Types 430 and 309 have proved to be well suited for exposure to the gaseous oxides of nitrogen at elevated temperatures as well as room temperature.

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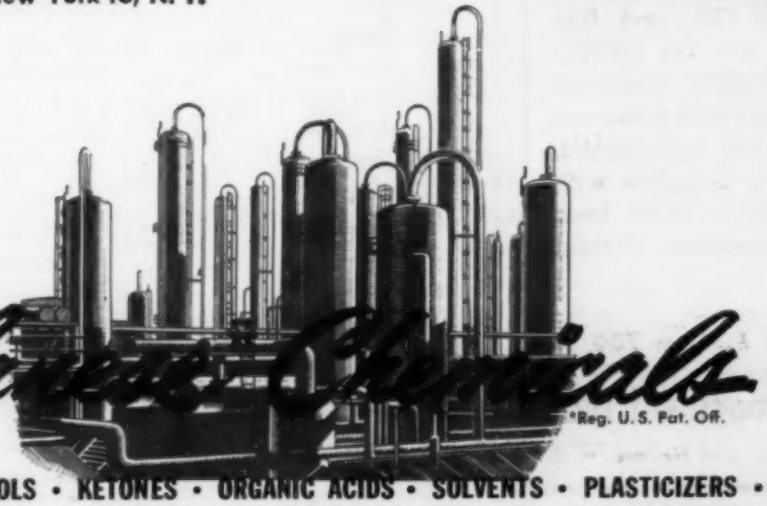

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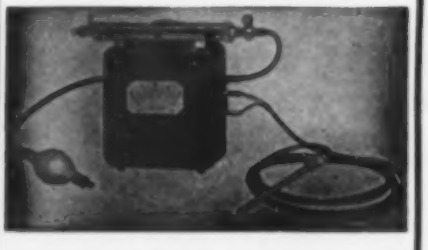

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corrosion resisting and physical requirements for most nitric acid applications. All equipment intended for the handling of nitric acid at high temperatures should be carefully fabricated to avoid stresses and carbide precipitation which render the metal susceptible to corrosive attack.

SILICONES

J. A. McHARD
Dow Corning Corp.
Midland, Mich.

RESISTANCE of commercially available silicone products to nitric acid was determined by laboratory tests conducted according to ASTM D 543-43. Typical samples of various silicone products were immersed in 10 percent nitric acid and in concentrated nitric acid for seven days at room temperatures and at 100 deg. C. The resistance of silicone fluids, silicone resins, and silicone rubber to dilute and concentrated nitric acid was measured by observing changes in viscosity, changes in weight, or changes in size, hardness and elasticity. These results were considered together with the condition of samples after such exposure and the resistance to nitric acid rated as good or poor.

Silicone Fluids—Data on the behavior of four different types of DC silicone fluids after exposure to dilute and concentrated nitric acid at room temperature and at 100 deg. C. are given in Table I. All of the silicone fluids tested had good resistance to dilute nitric acid at room temperature. All except the DC 710 fluid showed good resistance to dilute nitric acid at 100 deg. C. The DC 200 and DC 500 type fluids showed relatively little change in viscosity after seven days exposure to concentrated nitric acid at room temperatures. None of the fluids tested were resistant to concentrated nitric acid at 100 deg. C.

Silastic—The affects of dilute and concentrated nitric acid at room temperature and at 100 deg. C. on typical samples of various Silastic (DC silicone rubber) stocks are given in Table III. The best Silastic stocks are 180 and 181 which were developed especially for use as gasket materials of low compression set and good chemical resistance.

Silicone Greases—Of particular interest is the nitric acid resistance of the two silicone greases, DC Valve

Table I—Resistance of Silicone Fluids to Nitric Acid

Type Fluid	HNO_3 Conc., Temp.	Viscosity Increase, %	Evaluation*
DC 200	10%, Room	0.10	good
	100°C.	−4.56	good
	Conc., Room	6.16	good
	100°C.	247	poor
DC 500	10%, Room	3.18	good
	100°C.	−7.29	good
	Conc., Room	−9.73	good
	180°C.	374	poor
DC 550	10%, Room	9.68	good
	100°C.	−7.04	good
	Conc., Room	Decomposed	poor
	180°C.	Not tested	....
DC 701	10%, Room	7.69	good
	100°C.	18.0	poor
	Conc., Room	Decomposed	poor
	100°C.	Not tested	....

Tested according to ASTM D-543-43. *Ratings are based on observation of the test sample as well as on measurable changes in viscosity.

Table II—Resistance of Silicone Resins to Nitric Acid

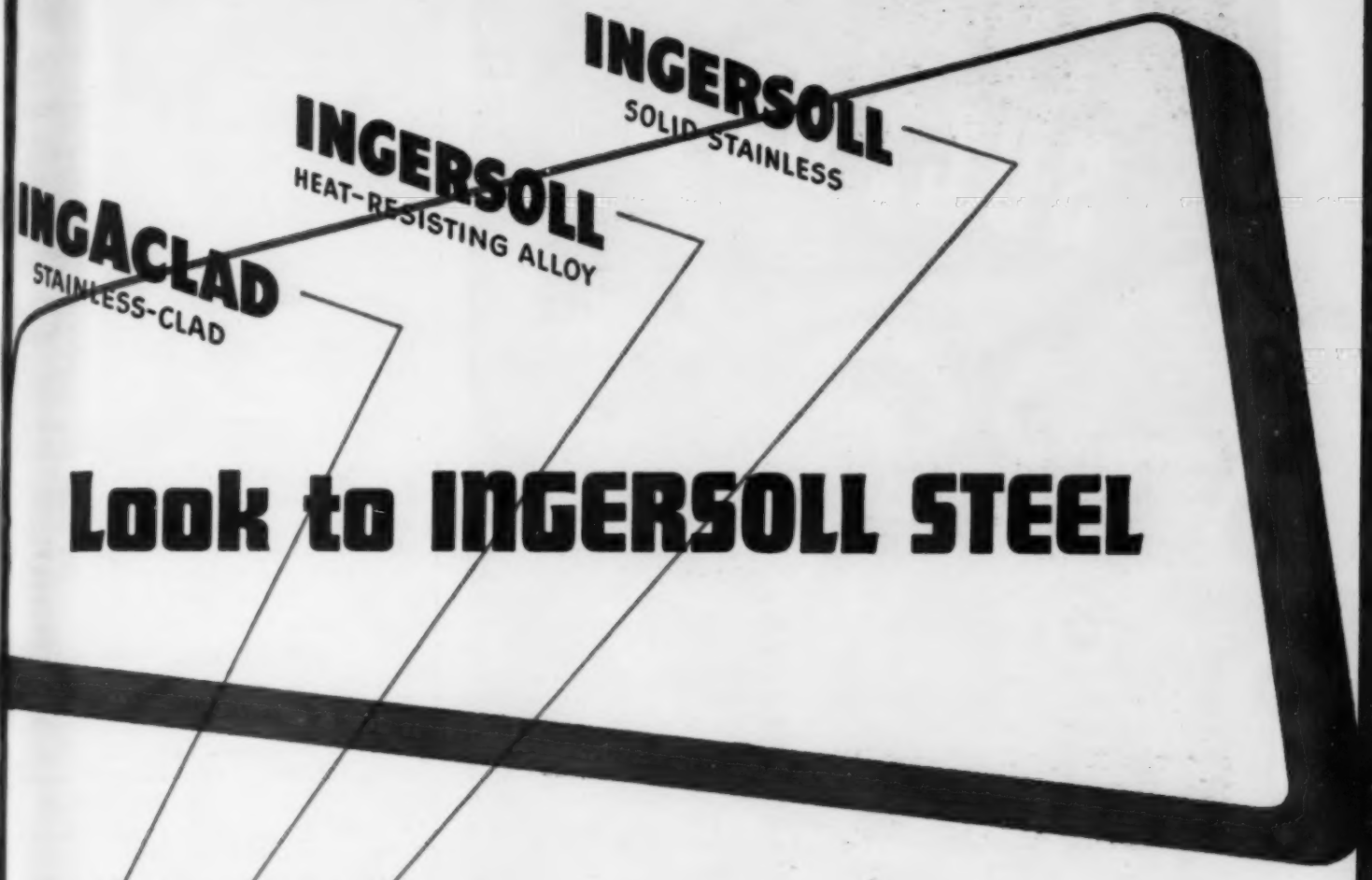
Type Resin	HNO_3 Conc., Temp.	Weight Increase, %	Evaluation*
DC 993	10%, Room	1.3	good
	100°C.	2.0	good
	Conc., Room	8.7	poor
	100°C.	...	poor
DC 996	10%, Room	0.1	good
	100°C.	−3.6	good
	Conc., Room	17.1	poor
	100°C.	...	poor
DC 2103	10%, Room	1.0	good
	100°C.	1.0	good
	Conc., Room	0.0	good
	100°C.	4.3	good

Tested according to ASTM D-543-43. *Ratings are based on measurable changes and physical appearance of samples.

Table III—Resistance of Silastic to Nitric Acid

Silastic Stock	HNO_3 Conc., Temp.	Vol. Increase, %	Wt. Increase, %	Hardness[1] Before Exposure	Hardness[1] After Exposure	Hardness[1] After Reconditioning	Elasticity[2] % Before Exposure	Elasticity[2] % After Exposure	Elasticity[2] % After Reconditioning	Evaluation
120	10%, Room	8.5	1.6	45	42	46	33	29	28	Good
	100°C.	67.6	−0.5	45	1	7	33	95	90	Poor
	Conc., Room			Specimen became soft and spongy						Poor
125	10%, Room	15.0	17.0	50	26	56	42	34	26	Fair
	100°C.	15.6	8.5	50	10	46	42	24	20	Poor
	Conc., Room			Specimen became soft and spongy						Poor
150	10%, Room	17.5	0.1	49	43	50	47	35	39	Fair
	100°C.	52.2	−18.1	49	25	30	47	35	35	Fair
	Conc., Room			Specimen became soft and spongy						Poor
160	10%, Room	6.3	−14.8	58	28	46	29	37	38	Fair
	100°C.	2.3	−24.5	58	10	35	29	45	28	Poor
	Conc., Room			Specimen became soft and spongy						Poor
160R	10%, Room	2.3	−4.4	48	43	51	47	38	44	Good
	100°C.	4.9	−20.5	48	19	30	47	37	36	Poor
	Conc., Room			Specimen became soft and spongy						Poor
167	10%, Room	32.5	22.6	74	12	86	22	26	10	Poor
	100°C.	33.3	21.3	74	1	60	22	30	4	Poor
	Conc., Room			Specimen became soft and spongy						Poor
180	10%, Room	0.2	0.6	70	62	77	20	39	17	Poor
	100°C.	31.5	31.3	70	29	64	20	22	14	Poor
	Conc., Room	15.2	0.8	70	39	90	20	24†	10	Poor
181	10%, Room	11.0	0.5	81	79	82	11	28	20	Poor
	100°C.	44.3	23.2	81	46	68	11	26	24	Poor
	Conc., Room	22.2	14.8	81	52	85	11	24	14	Poor

Tested according to ASTM D-543-43. [1]Shore hardness test. [2]Shore elasticity test.



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Silicone Resins—Typical samples of three silicone resins, namely the electrical varnishes DC 993, DC 996, and the laminating resin DC 2103, were exposed to dilute and concentrated nitric acid at room temperature and at 100 deg. C. Their evaluation is given in Table II. None of the silicone resin samples showed any significant change in weight or appearance after seven days of immersion in dilute nitric acid at room temperatures or at 100 deg. C; DC 2103 showed good resistance to concentrated nitric acid at room temperature and at 100 deg. C. After seven days in concentrated nitric acid at 100 deg. C. samples of DC 2103 were unchanged in size or appearance, but when broken the resin was powdery showing that the bonding strength had been affected.

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FROM THE LOG OF EXPERIENCE

Dan Gutleben, ENGINEER

DYER'S FIRST CONTRACT for a complete cane processing plant for raw sugar in tropical America came from Cuyamel Fruit Co. in 1920. The site of the mill was La Lima, Honduras, about 60 miles inland from Puerto Cortez and was reached by main line railroad to San Pedro and thence by the Company's ten-mile branch to the plantation. The fruit company's ships delivered men and materials from New Orleans to its pier at Puerto Cortez. The country was covered with dense jungle infested by snakes and monkeys.

In response to E. F. Dyer's advertisement, one D. R. ("Doc") Watson appeared, representing himself as a cane mill erector of skill. His manner inspired confidence and he was accordingly commissioned in the autumn of 1920 to recruit a crew of constructors and proceed to the site. Under the slogan, "Join Dyer and See the World," Doc attracted 40 artificers in steel erection and carpentry from the left-overs of Cleveland and New Orleans. The slogan, the $300 monthly stipend with subsistence, and the free transportation on the fruit company's ships, promised an exciting holiday. An added attraction was the invitation to the wives to join in the journey.

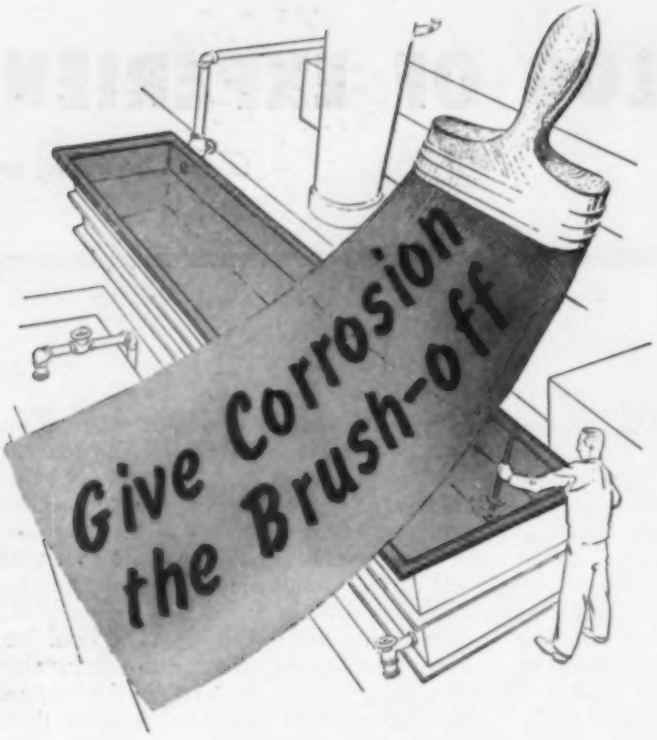
FOUNDATION WORK proceeded well enough under the geometry of civil engineer Felix, but the accounting did not meet Dyer's standard. Accordingly, he dispatched Hugh Berry, lately commercial agent on the Belmond, Iowa, contract, with instructions to be helpful. When Hugh reached the fruit company's office in New Orleans, he was told that Doc had come up for a holiday with his wife and was a guest at the St. Charles. Presently the twain got together. Doc was not quite ready to leave and he suggested that Hugh tarry in Puerto Cortez until he himself should arrive as there was nothing of sufficient importance at the site to warrant subjecting himself to the inconvenience of the construction camp. In the meantime Doc had some small items of baggage which he desired Hugh to take along. This included two guns and 1,000 loaded shells—a "hot" cargo. However, Doc was the boss and Hugh undertook obediently to carry out the request, albeit with certain misgivings. Hugh's large, old fashioned box camera could comfortably conceal 100 shells. The transfer from shore to ship therefore required numerous trips up and down the gang plank and an occasional pause for a pretended exposure. The guns got through safely in Mrs. Berry's trunks which by chance were not examined.

Doc arrived on the following voyage and claimed his property. By that time Hugh had established himself in one of the company's cabins at the construction site and Mrs. Berry organized housekeeping, specializing on rice and bananas and meat of doubtful pedigree and refrigeration.

HUGH FOUND construction progress in a depressing state for lack of efficient supervision. Doc was performing his duties as construction engineer for the most part by remote control from his apartment at San Pedro. The crew from the States had all returned but five, the reason being malaria or a surfeit of holiday and the eagerness to return to the old haunts. At least one had contributed only one half day's work in return for free transportation and travel time. Fortunately there was a small following of sugar tramps who flock to a construction camp like flies to molasses. And there were a few improvised foremen of varying qualities. The standard erection gear with which many a Dyer house had been efficiently erected, was rusting in the weeds. Doc maintained that the erection of the mill was a gin-pole job (i.e., one notch above the crude jack screw!). President Zemurray's representative expressed concern lest the plant be unready by harvest time. Hugh relayed this to Cleveland and Dyer ordered Manager Walter Blanchard, presently in Santo Domingo, to proceed to La Lima.

Doc met Blanchard at the Port with a courteous welcome and convoyed him to his quarters at a San Pedro hotel. There he entertained him with various exhibits, especially his collection of German automatics. He urged Blanchard to establish residence in San Pedro and avoid the crude facilities of the camp as he himself was doing. The Ford locomotive could deliver him comfortably to the job by 9 o'clock in the morning. However, Blanchard had no demand for personal comfort and accordingly moved to the factory site. He corroborated Hugh's report and learned that Doc's pride and joy were his guns and his skill as a hunter of wild animals. His companions were big, bold, interesting characters of the kind who emigrated from the West upon the arrival of two-gun sheriffs. Under the law of the land these men could not be extradited. Blanchard tactfully, convinced Doc that, as time was running against them, the work should be expedited by the help of A. K. ("Art") Thelin, an erector of long experience, who was now available, having just finished the Belmond, Iowa, house. In due time Thelin arrived and injected life into the job. There was no cooperation from Doc and in fact he was detrop. Under this circumstance Blanchard called him to conference. When he emerged and passed Hugh's desk he resembled a rooster just from a fray and he told Hugh he was checking out. Some few unfaithfuls, subject to Doc's influence, left with Doc. Felix being Blanchard's fellow alumnus from Tulane, remained. Thereafter the drama was translated into prosaic routine. When the job was on an even keel, Blanchard returned to Cleveland. Thelin finished the work with dispatch under the usual style of Dyer efficiency and delivered a creditable job just ahead of the harvest.

THE RIGHT OF WAY of the fruit company's railroad connecting the town of San Pedro with the mill site, ten miles out, was lined on either side with posts which served as property delineation and support for telegraph



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wires. These posts sent out sprouts and in an amazingly short time formed a protecting hedge. The space within had been cleared when the track was laid. The soil, having been sweetened by sunshine for the first time in some centuries, sent up a terrific growth of jungle, leaving a canyon in the middle just wide enough for the cars to brush through. Passenger service was provided by a Ford Model-T, fitted with flanged wheels.

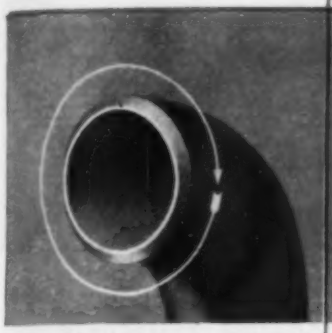
On pay day Hugh Berry used this facility to transport the weekly payroll money from San Pedro. He was usually accompanied by a shrinking native who carried a gun to bolster his inferiority complex. On one occasion, with $9,170 in paper and $800 in silver in his bag, Hugh fetched up against a blockade of railroad ties. At the same time several glistening gun barrels projected over the tracks from the jungle and one of them flashed a warning. A voice ordered hands up and forward march. After a time Hugh and his companion sensed that they were alone and so they returned to the locomotive. They found that a machete had cut a window through the money bag. The paper was gone but the silver and the harmless "blunderbus" remained. The episode added $9,170 to Hugh's profit-and-loss account and constituted the amount by which the cost of the plant exceeded the contract price. The local Commandante issued much verbal fireworks but there was no action to catch the thieves.

THE ACCOMPLISHMENT under the contract price of $1,381,000 was the erection of nearly 5,000 tons of equipment at a cost of $1,392,000. The labor account exceeded the estimate by $52,000 which included $17,000 to cover the generosity to the holiday-making mechanics. If Hugh's pay roll had been convoyed by a United States Marine (one would have been enough) the cost and contract would have broken even!

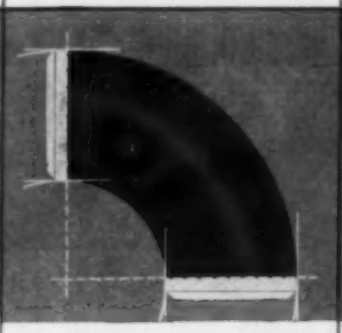
AN OLD PREDECESSOR, with leisure to spare, called on Hank Sandmann at Loveland last winter at the height of his battle against snow, frozen beets and John Lewis' coal strike. After the manner of his tribe he brushed aside Henry's complaint and forthwith started belittling under the famous preamble, "Why, in my time—" etc. adinfinitum. He intimated that Progress had crescendoed up to the time of his retirement and then suddenly stopped! Henry fortunately was able to produce the records. What a surprise! Henry's worst was superior to the best his predecessor could claim!

What do YOU want in a welding fitting?

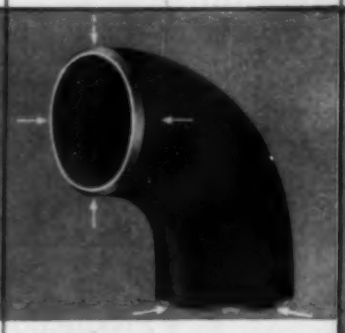
These *PLUS* features are combined in WeldELLS and other Taylor Forge Welding Fittings.



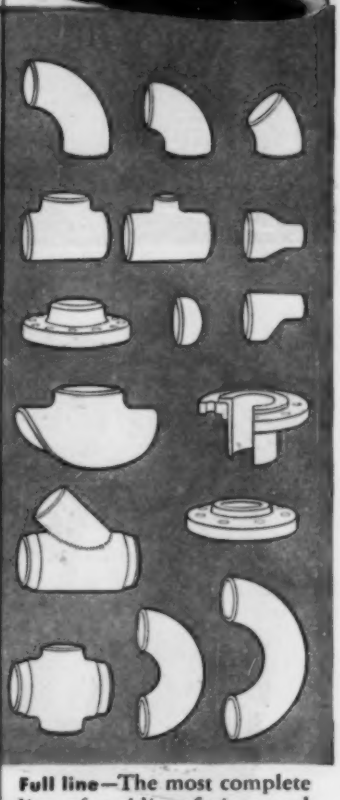
Seamless—No question about soundness in a fitting that is forged and formed seamless.



Tangents—Keep weld away from zone of greatest stress—simplify lining up.



Precision quarter-marked ends—Expedite layout; insure accuracy. A constructive refinement.



Full line—The most complete line of welding fittings and forged steel flanges in the world—greatest range of types, weights, sizes.

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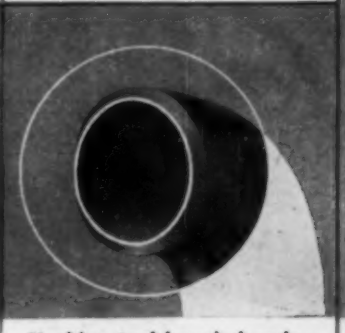
Wall thickness never less than specification minimum—Assures full strength and long service life.



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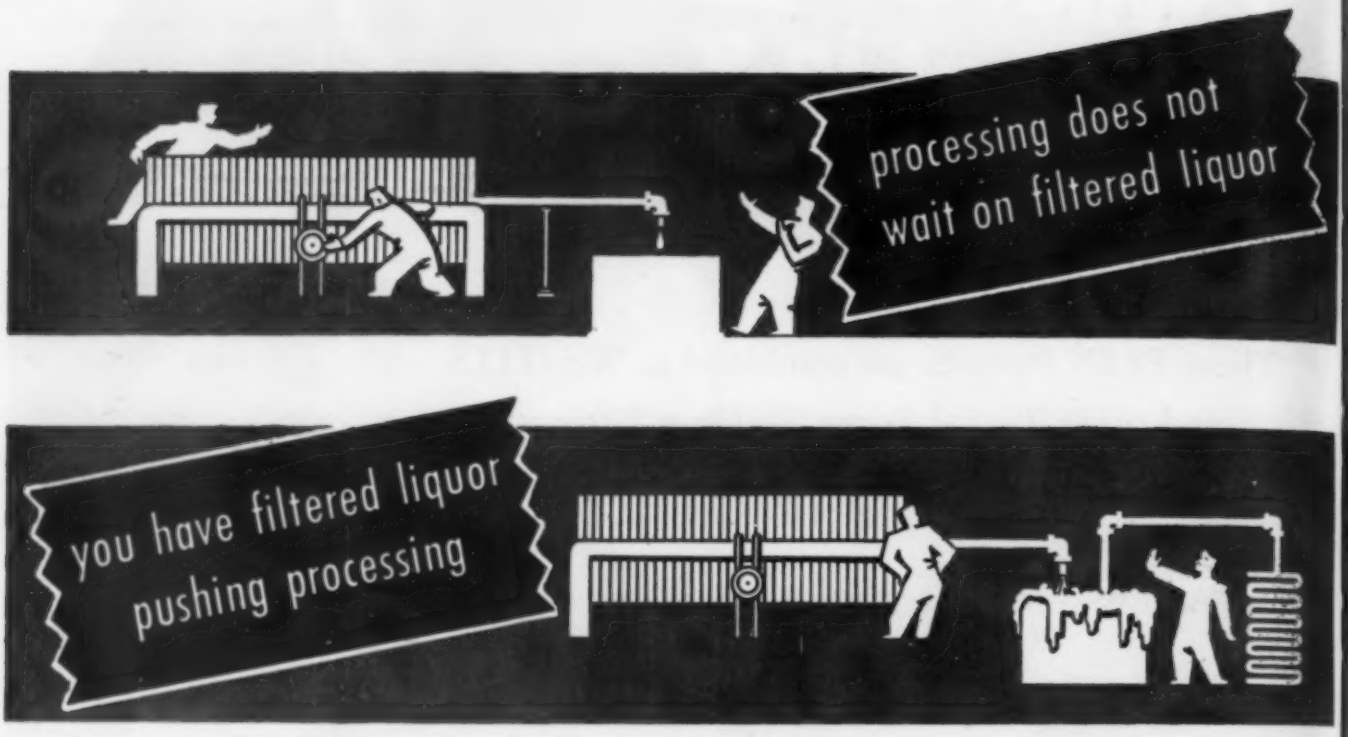

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NAMES IN THE NEWS

Man of the Month

Fabian Bachrach

G. J. Esselen

First presentation of the James F. Norris award was made recently to Dr. G. J. Esselen. The award is a mark of distinction given in memory of the late head of M.I.T.'s research laboratory of organic chemistry. It was given as part of the fiftieth anniversary meeting of the Northeastern Section of the American Chemical Society. Dr. Esselen received the honor as a result of his outstanding work for the section. He is a councillor, trustee of permanent funds, has served twice as chairman, and is representative to the ACS council.

Gustavus John Esselen was born in Roxbury, Mass., June 30, 1888, and received his first Harvard degree magna cum laude in 1909. In 1921 he was made vice president and director of research for the firm of Skinner, Sherman and Esselen. Prior to that he had been associated with General Electric Co., Chemical Products Co., and Arthur D. Little, Inc. Since 1930 he has been president and treasurer of Gustavus J. Esselen, Inc.

Dr. Esselen is well known nationally and internationally. He has served as a delegate at meetings of the International Union of Chemistry. During the war he was consultant to several committees, among them the famous one of Dr. Baruch. He is an active member of a number of societies including ACS, AAAS, AIC, TAPPI, SCI and AIChE. His home is in Swampscott; his offices in Boston.

Gage Lund has been elected to the board of directors of Standard Oil Co. of California.

Charles G. Dryer has been appointed manager of the Tennessee Eastman Corp. research laboratories at Kingsport, Tenn. **Joseph B. Dickey** is associate director of research in charge of Tennessee Eastman Products division of the Kodak Research Laboratories in Rochester, N. Y.

Joseph B. Quig, assistant manager of the development section of the Du Pont company's rayon technical division, has been appointed instructor for a new course on textiles initiated last month by the University of Delaware.

Herman A. Bruson has joined the Industrial Rayon Corp. as head of the high polymer research division in the main laboratories at Cleveland.

Malcolm H. McVickar has become chief agronomist of the National Fertilizer Association with offices in Washington.

Y. F. Hardcastle, vice president in charge of manufacturing, has been elected a member of the board of directors of the Pennsylvania Salt Manufacturing Co.

Y. F. Hardcastle N. L. Drake

Nathan L. Drake, chairman of the department of chemistry in the University of Maryland and head of the research group which synthesized the two best antimalarial drugs developed during the war, has been awarded the 1948 Hillebrand Prize of the Chemical Society of Washington, D. C. The prize was presented to Professor Drake on March 11, at the annual dinner of the section.

H. E. Dudycha has been appointed operations superintendent of the industrial oil unit of Swift & Co.'s new technical products in Hammond, Ind.

H. E. Dudycha L. W. Bass

Lawrence W. Bass has been elected a vice president of U. S. Industrial Chemicals, Inc. He will continue as the company's director of research and development.

Milton J. Scott, of Springfield, Mass., has been appointed assistant director of research of Monsanto Chemical Co.'s Merrimac division. He will direct and supervise textile research and application at Merrimac headquarters in Everett, Mass. In addition, he will have charge of coordinating research with textile sales development as well as with other production groups of a similar nature.

Philip L. Wormeley, assistant chief of the division of organic and fibrous materials and chief of the section on testing and specifications of the National Bureau of Standards, retired on Dec. 31. **Gordon M. Kline**, chief of the organic plastics section has been appointed to Mr. Wormeley's position in the division of organic fibrous materials. **Robert D. Stiehler** is now chief of the testing and specifications section.

Abbott Byfield, manager of the research and development laboratories of the Kimberly-Clark Corp., Appleton, Wis., has been elected chairman of the Northeast Wisconsin section of the American Chemical Society, succeeding **Paul E. Truttschel**, re-

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search chemist of the Appleton Coated Paper Co.

Edwin D. Lowthian has joined the Mixing Equipment Co., Inc., Rochester, N. Y., as senior process engineer to augment the company's field engineering service.

G. H. Stempel, Jr. J. E. Ablard

G. S. Schaffel H. L. Wunderly

G. H. Stempel, Jr., former associate professor of organic chemistry at Carnegie Institute of Technology, has been made assistant director of research and **J. E. Ablard** is now director of synthetic rubber research and development for General Tire & Rubber Co. Other new appointees are: **G. S. Schaffel**, director of plastics research and development; **H. L. Wunderly**, director of analytical research; **H. T. Roy**, director of all activities of the Aerojet division of Azusa, Calif., in the Akron laboratories; and **Kermit Weinstock**, acting head of physical testing and compounding research.

Carl E. Miller has been named to the research advisory staff of Battelle Institute, Columbus, as part of its expanded fuels and combustion research.

Alfred J. Knapp, executive vice president of Napko Paint & Varnish Works, Houston, Tex., has been elected Southwestern regional vice president by the National Paint, Varnish & Lacquer Association.

Ivan Bloch, formerly chief of the division of industrial and resources development, Bonneville Power Administration, has entered private practice as an industrial engineering consultant in Portland.

Allan M. Short, formerly mineral technologist, Missouri Pacific Lines, St.

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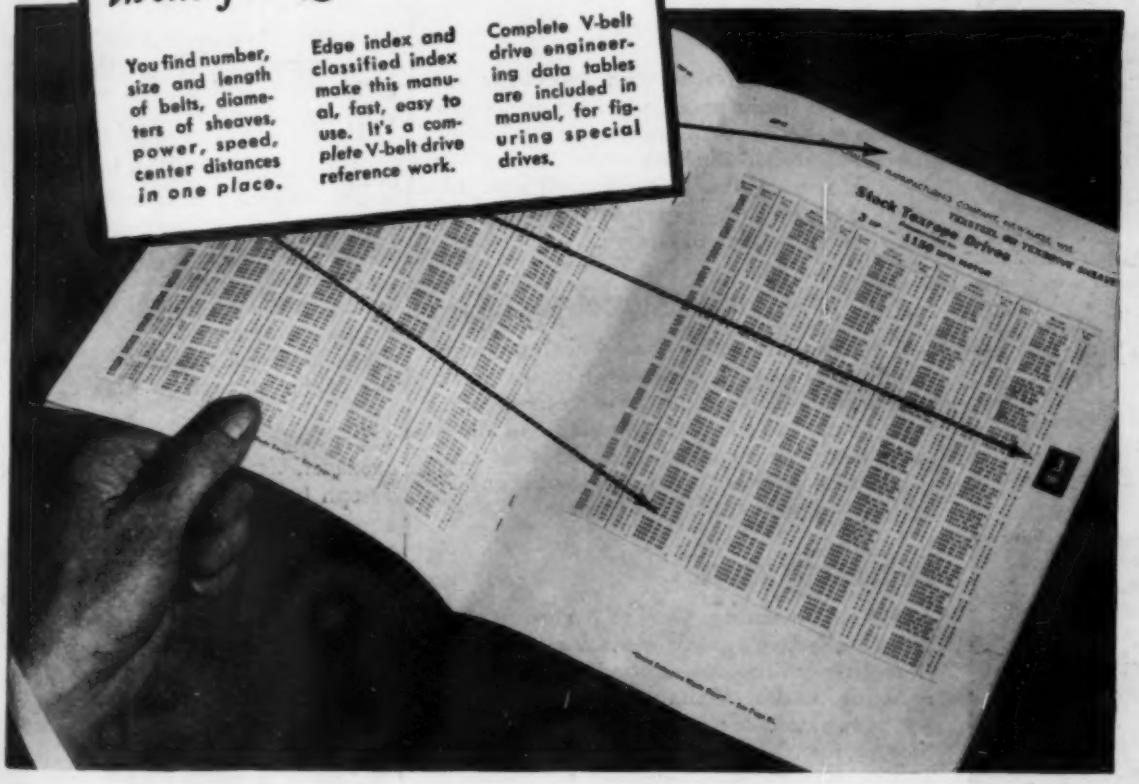
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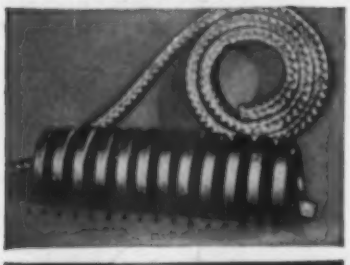

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Louis, is engaging in private practice as geologist and mineral technologist specializing in industrial raw materials.

John Dew has been appointed to the Aluminum Co. of America fellowship in the school of chemical engineering, University of Oklahoma, Norman.

Edward B. Nitchie has been appointed manager of operations and engineering of Basic Refractories, Inc., Cleveland. He was formerly associated with Cutter Laboratories of Berkeley, Calif., as works manager.

F. R. Ward has resigned as assistant section chief in the process design section of the Clinton National Laboratory, Oak Ridge, Tenn., to work as an assistant in the production department of the plastics division, Monsanto Chemical Co., Springfield, Mass.

Gaylord L. Barrick has been appointed head process engineer of the Votator division of the Girdler Corp., Louisville, Ky.

Carl F. Cori, professor of biochemistry in the Washington University School of Medicine, St. Louis, and Nobel Prize Winner in medicine last year, has been awarded the 1948 Willard Gibbs Medal of the Chicago section of the American Chemical Society. He will receive the award at a meeting of the section on May 21.

Harry E. Outcault has been appointed manager, Zinc oxide sales, for the St. Joseph Lead Co., New York.

H. E. Outcault

B. Klaussen

Bjarne Klaussen has been promoted to vice president in charge of production of the Hooker Electrochemical Co., Niagara Falls, N. Y. Mr. Klaussen, a graduate of the University of Oslo, has been a member of the Hooker organization since 1916. He has been works manager of the Niagara plant since 1940 and a member of the company's board of directors since 1942.

Sherman S. Shaffer, head of the experimental and testing division of the Humble Oil & Refining Co., Baytown, has been elected chairman of the Southeastern Texas section of the

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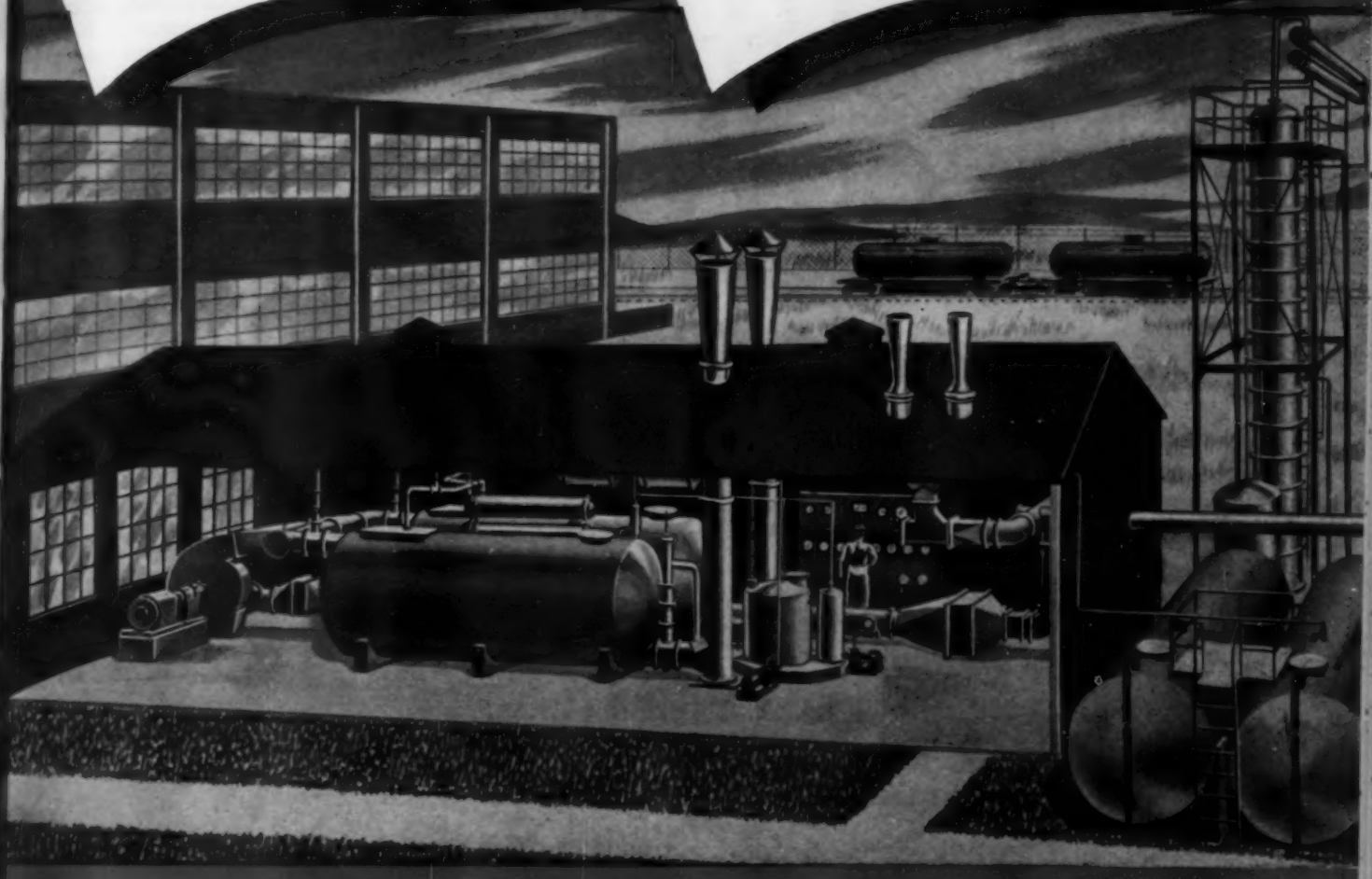

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American Chemical Society. He succeeds **Briggs B. Manuel** of W. H. Curtin & Co., Houston, who was named to the society's national council.

Ivan Vavruch and **Milos Hudlicky**, the first two foreign chemists selected for advanced study in the United States on grants provided through the American Chemical Society to the United Nations Educational, Scientific, and Cultural Organization have arrived in this country and begun work. Both are from Czechoslovakia. Dr. Vavruch, 28, will study colloid chemistry at the Massachusetts Institute of Technology, and Dr. Hudlicky, 28, will specialize in fluorine chemistry at Ohio State University.

E. C. Speiden

E. T. Ladd

Eben C. Speiden, senior vice president and works manager of the Isco chemical division, Innis, Speiden & Co., has retired from active duty as works manager at Niagara Falls, N. Y. He will continue to be associated with the company management. **E. T. Ladd**, general superintendent and chief chemist of the Isco chemical division, has been appointed works manager.

Fred S. Lodge, long associated with National Fertilizer Association, has been named assistant to the president of NFA. In his new position he will be handling not only technologic problems but also many association policy questions.

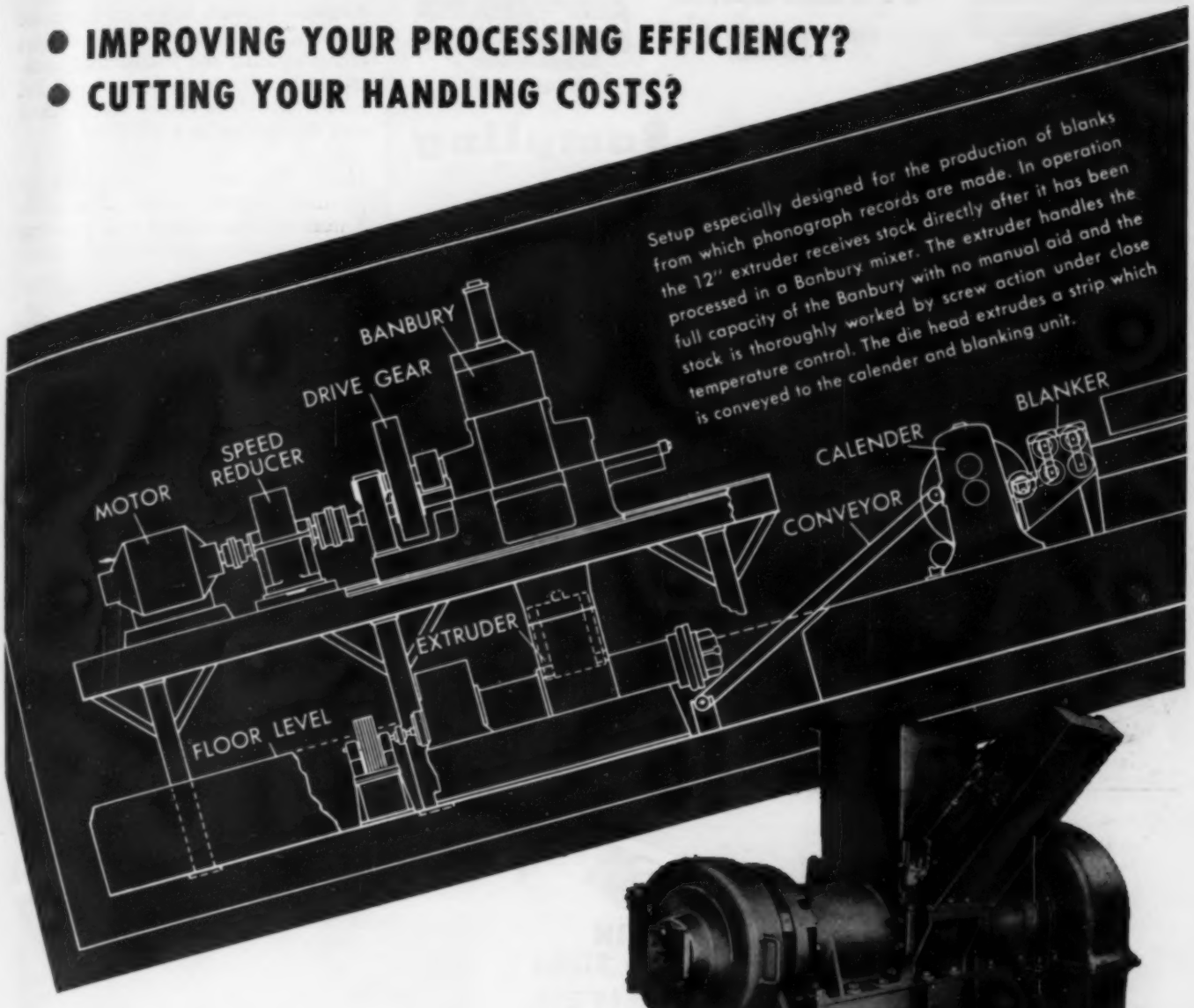
S. Askin

R. N. Lulek

Simon Askin and **Ralph N. Lulek** have been named vice presidents and elected to the board of the Heyden Chemical Corp. Mr. Askin has been associated with Heyden since 1943 and has been an officer since 1945. Dr. Lulek has been research manager of Heyden since 1946 and has also

Does this layout give you an idea for

- **IMPROVING YOUR PROCESSING EFFICIENCY?**
- **CUTTING YOUR HANDLING COSTS?**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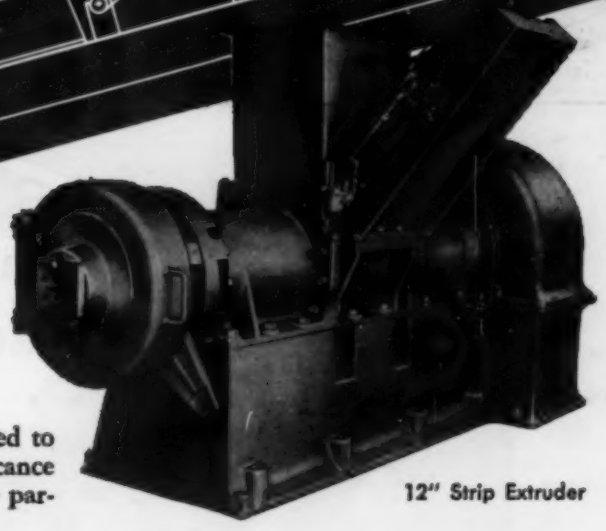

12" Strip Extruder

The special processing setup in this layout was designed to solve a specific problem for one company. Its real significance lies in the approach to the problem rather than in the particular solution.

For many years Farrel-Birmingham engineers have been called in by one company after another to formulate plans for improving the "flow" in processing rubber and plastics stocks. This layout is only one of the many successful solutions that have been worked out for specific problems.

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had charge of the ammonia and antibiotic divisions of the company.

Marshall J. Goss has been appointed assistant to the chief of the Bureau of Agricultural and Industrial Chemistry to handle research contracts and related activities under the Research and Marketing Act of 1946.

Harry W. Loesecke has been appointed assistant to the chief of the Bureau of Agricultural and Industrial Chemistry as adviser on food research problems.

Paul H. Giddens, Allegheny College professor and an authority on the history of the petroleum industry, has been granted a two-year leave from teaching duties to write a history of the Standard Oil Co. of Indiana.

J. Richard Adams has been promoted by Spencer Chemical Co. to the position of director of technical services. His offices are in Kansas City.

J. R. Adams W. C. Kirschner

William C. Kirschner has been added to the staff of the plastics and coatings department, chemical products division, the Goodyear Tire & Rubber Co., Akron.

G. M. Juredine, technical coordinator with the Harshaw Chemical Co., is the new chairman of the Cleveland section of the American Chemical Society.

E. D. Cumming has become regional vice president of Shell Oil Co. at Houston, Tex. Since 1946 he has been manager of Shell's American Department in London. Mr. Cumming succeeds **A. J. Galloway** in Houston, who has become vice president in charge of exploration and production in the company's New York office.

William A. Adamson, a pioneer in dye research, retired last month after 30 years with the Du Pont company.

Edward G. F. Arnott has been appointed assistant director of research for the Westinghouse Lamp division.

Donald T. Jackson has been appointed director of the Hammermill Paper

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The Payloader Buggy has a load capacity of 5,000 lbs. The 2 cu. yd. body is low, long and wide to facilitate loading by Payloaders, cranes, tractor shovels or by hand. Hydraulic power dumps the loads exactly where and as fast as desired. Short wheel base, low height, rear wheel steer and large easy-rolling wheels enable this Buggy to operate indoors or out, on paved or unpaved surfaces, in congested low head-room areas, through narrow aisles and doorways. Hydraulic brakes plus full operator visibility permit high travel speeds with complete safety.

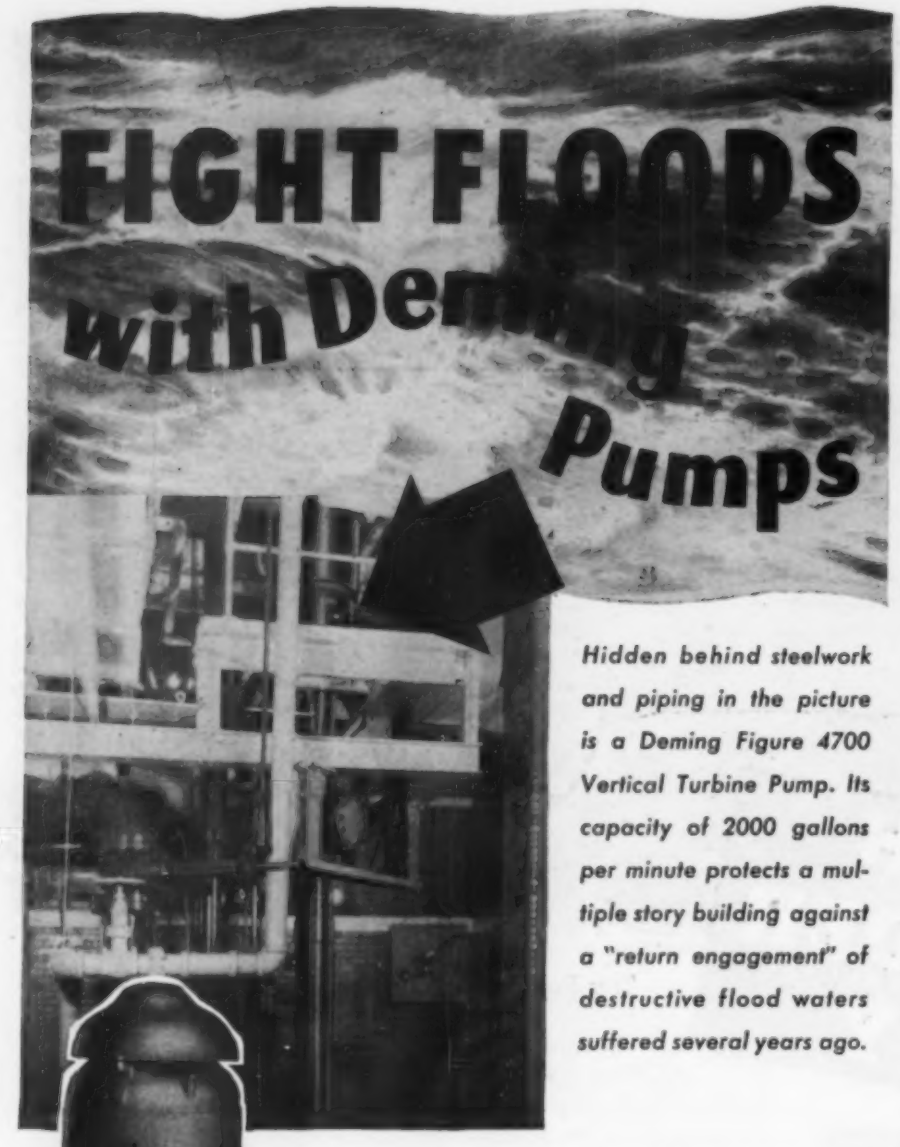
Carries all kinds of bulk materials — dumps easily and cleanly by hydraulic power.

This new Hough product carries all kinds of bulk materials such as chemicals, fertilizer, clay, sand, coal, waste, slag, etc. . . . is sold and serviced by a world-wide distributor organization. It will pay you to get complete details.

THE FRANK G. HOUGH CO.

2000 Sunnyside Ave. Libertyville, Ill.

TRACTOR SHOVELS SINCE 1920



Hidden behind steelwork and piping in the picture is a Deming Figure 4700 Vertical Turbine Pump. Its capacity of 2000 gallons per minute protects a multiple story building against a "return engagement" of destructive flood waters suffered several years ago.

A 12-foot flood followed a hurricane that swept a New England city several years ago. To prevent a recurrence of its huge loss, one company invested in a Deming Vertical Turbine Pump like the one illustrated at the left. That company is amply prepared to fight the worst flood that could ever strike again.

Controlling flood conditions is only one of many applications of Deming Vertical Turbine Pumps. Other services include condensation return and boiler feed installations and, with the deep well type of construction, these pumps are used widely for low cost water supply. Complete details are available in BULLETIN 4700-8. Write for a copy.

THE DEMING COMPANY
525 BROADWAY • SALEM, OHIO

DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

Co. Laboratories at Erie, Pa. He succeeds the late **Bjarne Johnsen.**

Marvin J. Udy has opened an office in Niagara Falls for consulting in the field of process metallurgy.

Emil Heuser, formerly professor at the Institute of Paper Chemistry, Appleton, Wis., has been awarded the 1948 Gold Medal of the Technical Association of the Pulp and Paper Industry.

J. M. Graham, Jr., has been named director of a newly formed senior technologists group in the process section of Monsanto Chemical Co.'s general engineering department. Other members of the new group, established to provide specialized technical aid to all divisions and departments of the company are: **Hart U. Fisher,** instrument technologist; **Alban J. Lobdell** and **Robert York, Jr.,** chemical engineering technologists; and **Frank LeRoy Whitney, Jr.,** corrosion technologist.

Robert Q. Wilson has been appointed to the staff of Battelle Institute, Columbus, Ohio, where he will engage in chemical engineering research.

William Home has been assigned to the operating branch of the plants division, Chemical Corps Technical Command, Army Chemical Center, Md. During the war, Lt. Home served as an Infantry officer with the 75th Infantry Division in the European theater. He is a chemical engineering graduate of the University of Washington.

Eugene G. Rochow, formerly research chemist with the General Electric Co. in Schenectady, is now associate professor of chemistry at Harvard University. Dr. Rochow is an authority on the silicon compounds.

Dan Dinsmoor, formerly with Monsanto, has joined American Potash & Chemical Corp., Los Angeles, to head the development department.

Ronald B. McKinnis has been appointed manager of technical services of the Votator division of the Girdler Corp., Louisville, Ky.

J. J. Press has resigned as vice president and director of textile research for the Manufacturers Research Laboratories and is now located in New York as consultant to the textile and chemical industries.

Charles S. Munson, formerly president of Air Reduction Co., Inc., has been elected chairman of the execu-

HYDRAULIC EXPANSION

means better contact

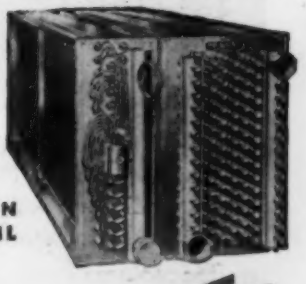
McQuay

AIR CONDITIONING COILS

Superior contact fin to tube—assured turbulence of the heating or cooling medium—two reasons for top performance in McQuay air conditioning coils. Exclusive Ripple-Fin coils are formed by a process in which copper tubes are hydraulically expanded into plate type aluminum fins under pressures up to 4500 PSI, assuring maximum heat transfer between primary and secondary surfaces. Rippled inside tube surfaces, created in the expansion process, add necessary turbulence to the liquid or gas medium for greater heat transfer.

Practically limitless in range of sizes and capacities, McQuay coils for water, steam, direct expansion or combination uses are engineered to meet your requirements. See your McQuay representative or write McQuay, Inc.

Representatives in Principal Cities.



COMBINATION COIL

STEAM BLAST COIL

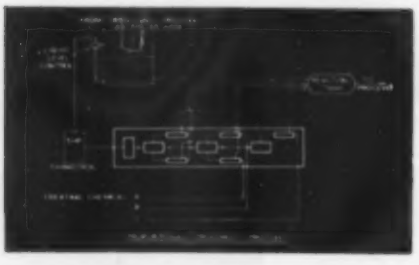
McQuay Inc.

HEATING • AIR CONDITIONING • REFRIGERATION

MILTON Roy PUMPS

Regulating the Speed of Controlled Volume Pumps *Automatically* by Means of Liquid Level Control

In this typical processing application the product, received from an open end process at 20 to 35 gals. per min. is treated with three chemicals, added at rates exactly proportional to the rate at which the material is



received. It is then pumped under pressure to a reaction vessel.

A 5-cylinder Milton Roy Controlled Volume Pump is used in this system. The 2 large cylinders handle the liquid from a surge tank fitted with liquid level control. The 3 small cylinders add the three treating chemicals. The speed of the drive of this combined pumping unit is automatically regulated through Thymotrol by the liquid level in the surge tank. If the level rises or falls the entire unit speeds up or slows down instantly in exact proportion to the speed of the first 2 cylinders. It is possible by manual stroke adjustment to change the ratio of each of the three treating chemicals while the system is in operation.

Milton Roy Controlled Volume Pumps are finding many such applications, in many fields, for a wide range of chemical treating purposes. Milton Roy engineers are competent to help develop similar systems and build pumps to meet specific requirements. Consultation is invited.

Write for the latest Milton Roy Pump Catalog No. 146

MILTON Roy COMPANY

1322 E. MERMAID AVE., CHESTNUT HILL, PHILA. 18, PA.

tive committee. He is succeeded by **John A. Hill**, who becomes the fifth president of the company. **William C. Keeley**, formerly vice president, was elected chairman of the newly created finance committee. **C. E. Adams** remains chairman of the board of directors.

Walter N. Munster, John T. Cox, Jr., and **Sam D. Morgan** have been designated deputy directors for the Office of Rubber Reserve. Mr. Munster will be responsible for all plants for the production of raw materials and catalysts, and of production control functions for all Rubber Reserve plants. Mr. Cox will be responsible for all the synthetic rubber manufacturing operations including basic raw materials for the neoprene plant.

E. M. Frost, Jr., supervisor of helium development at the United States Bureau of Mines plant in Amarillo, Tex., has been elected chairman of the Panhandle Plains section of the American Chemical Society, succeeding **Rector P. Roberts** of the Phillips Petroleum Co., Phillips, Tex.

OBITUARIES

Steuart E. Tray, 43, manager of the chemical processing machinery section of the Allis-Chalmers basic industries department, died at his home in Milwaukee January 17.

John Hugh Griffin, 52, vice president in charge of sales and a director of Publicker Industries Inc., died in Merion, Pa., January 21.

Julius F. Roten, 59, vice president and director of L. Sonneborn Sons, Inc., died in New York January 24.

August C. Klein, 60, vice president and engineering manager of the Stone & Webster Engineering Corp., Boston, died of a heart attack while on a vacation trip to Jamaica, B. W. I., February 3.

M. Vincent O'Shea, Jr., 49, administrative vice president of Merck & Co., Inc., manufacturing chemists, died in New York February 5.

Josiah Kirby Lilly, 86, chairman of the board of Eli Lilly and Co., pharmaceutical manufacturers, died in Indianapolis February 8.

Joseph Hidy James, 79, professor emeritus and first head of the department of chemistry and chemical engineering at the Carnegie Institute of Technology died in Pittsburgh February 12.

No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

For Fuel Savings and Maximum Production

INSTALL AN INDIVIDUAL ARMSTRONG STEAM TRAP ON EACH UNIT

WHY UNIT TRAPPING IS ESSENTIAL: If you try to drain condensate from more than one steam-consuming unit with the same trap, sluggish heating and low temperatures will almost always result. This is because no two units condense steam at the same rate. The pressure will be lowest in the unit condensing steam the fastest. Condensate from the higher pressure unit will back up into the lower pressure unit (or close the check valve), temporarily blocking off its drainage. This prevents escape of air and condensate, lowers the machine temperature and wastes fuel. However, the use of a separate trap on each unit permits individual operation without any effect from different condensing rates. You get maximum temperatures and maximum production.

WHY *ARMSTRONGS* ARE BEST FOR UNIT TRAPPING: They not only discharge condensate as fast as it accumulates, but they discharge air as well. This is essential to fast heating and uniform high temperatures. Furthermore, you don't have to be afraid of increasing the number of traps in your plant because Armstrongs seldom need attention. They won't clog or stick; dirt is swirled right through; the chrome steel valve and seat and corrosion-resistant stainless interior stand up in constant service for years and years.

THE ARMSTRONG STEAM TRAP BOOK gives complete data necessary for selection, installation and maintenance of Armstrong traps. Send for a copy.

ARMSTRONG MACHINE WORKS
858 Maple Street • Three Rivers, Michigan

ARMSTRONG *Inverted Bucket* STEAM TRAPS

No. 3 of a series of advertisements devoted to improving efficiency through better trapping.

MONARCH CORROSION RESISTANT NOZZLES

Of

Fig. F-80

STAINLESS STEEL:

Available in capacities from .57 G.P.H. Fig. F-80 style illustrated, to 104 G.P.M. (Fig. B-8-A style).

"Hollow" cone, "Solid" cone, and "Flat" sprays furnished in pipe sizes and capacities to suit practically any problem where corrosive liquids are sprayed.

STONEWARE:

Monarch Fig. 6020 and Fig. 6040 stoneware sprays have replaced most other types of nozzles used in acid chamber plants throughout the world. Last almost indefinitely in sulfur gases and will not break or crack from temperature changes.

HARD RUBBER:

Patented Fig. B-27 nozzle is of the "non-clog" type, i.e. it contains no internal vanes, slots, or deflectors which might facilitate clogging. Available ¼" to 1" pipe. Small sizes produce a very fine, soft, wide angle hollow cone spray, even at low pressures.

Fig. H-407 "flat" spray produces a relatively fine even sheet of liquid.

Write for Catalogs 6A and 6C

MONARCH MFG. WKS, INC.
2513 E. ONTARIO ST.
PHILADELPHIA 34, PA.

INDUSTRIAL NOTES

Hercules Powder Co. (Canada) Ltd., now has its cellulose products and naval stores departments in the Metropolitan Building, 44 Victoria St., Toronto, Ont. John O'Neill is in charge of the office.

Pennsylvania Flexible Metallic Tubing Co., Philadelphia, has appointed William Townsend general sales manager. Edward Sala has been made manager of the midwest branch.

Waterous Co., St. Paul, Minn., has appointed the following representatives of the Thompson Pump division: Park Duncan, Arthur W. Schuster, Clinton Sayres, and Arthur P. Sisson.

Lincoln Electric Co., Cleveland, has appointed G. F. Clipsham assistant to the president.

General Controls Co., Glendale, Calif., has appointed E. B. Maire as sales manager of eight of its midwestern, southern and eastern branch offices.

General Electric Co., Pittsfield, Mass., has named William B. Frackleton central district sales manager of their chemical department. His headquarters will be at 840 South Canal St., Chicago. Andrew Westhead has been made sales manager of the New England district.

Brown Instrument Co. has opened a district office at 922 Dermon Building, Third and Court Sts., Memphis, Tenn. Recently they have also established offices at Denver and Salt Lake City.

Westinghouse Electric Corp., Pittsburgh, has announced the retirement of Bernard Lester, assistant manager, headquarters, industrial sales department.

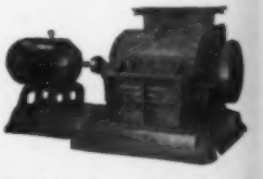
E. I. du Pont de Nemours & Co. Wilmington, has appointed Harold B. Garrett assistant director of purchases. He succeeds Thomas W. Harris, Jr., who became director of purchases with the retirement of Ernest H. Hawkins.

Chain Belt Co., Milwaukee, has elected L. B. McKnight and O. W. Carpenter directors.

Air Reduction Co. has appointed four vice presidents of its new subsidiary,

AMERICANS—to Fit Every Crushing Job

From laboratory grinding of samples for analysis—to tonnage crushing of fibrous or friable materials for production there's an AMERICAN CRUSHER to do your particular job *better*. Capacities from pounds to 500 tons per hour . . . with rolling or shredder rings, regular or special hammers for the exact reducing action needed.



"24" Series—ring or hammer crushers — Capacities to 50 TPH.

"30" Series Hammermill — Capacities to 100 TPH.

"AC" Ring mill — Capacities to 500 TPH. Fitted with American's exclusive shredder rings for high tonnage reduction.

Laboratory mill — for testing, pilot plant operation or crushing of waste materials for disposal.

American plastics scrap grinder—for reducing thermoplastics sprues and rejects. Cap. to 450 lbs. per hr.

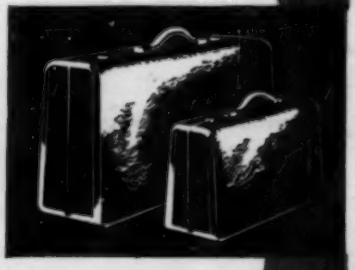
Write about your crushing problems or send samples of material.

American PULVERIZER COMPANY
Originators and Manufacturers of Ring Crushers and Pulverizers
1219 Macklind Ave.
St. Louis 10, Mo.

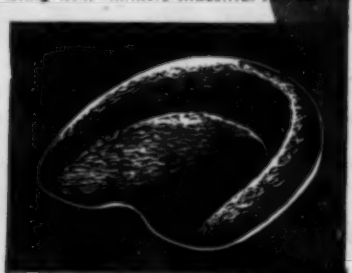
Fountain of USE!

● Flintkote [illegible]rants are widely used for [illegible]nd in the Rug and Carpet [illegible]ove wear and appearance [illegible]product.

● In tire manufacture, Flintkote [illegible] Solutioning for rayon and cotton [illegible] insures a firm, durable bond of [illegible] carcass... so important to tire li[illegible]



● New adhesives are replacing [illegible] riveting and other old methods [illegible] ing in many industries. Many [illegible] makers save time and money [illegible] bling with Flintkote Industrial [illegible]



● Flintkote Binder Compounds [illegible] ing many fabricators speed up the [illegible] tion. Among the uses of such co[illegible] are curled hair (above) and glas[illegible]

● Out of Flintkote research flows new *utility* for elastomers. With it, come advantages in performance and *use* to manufacturers and processors.

Flintkote has applied research to many compounding problems. And, as a result, offers a wide line of rubbers, resins, latex compounds and asphalts, both as aqueous dispersions and solvent cements.

These materials... designed for standard or special requirements... are supplied either by drum or tank-car.

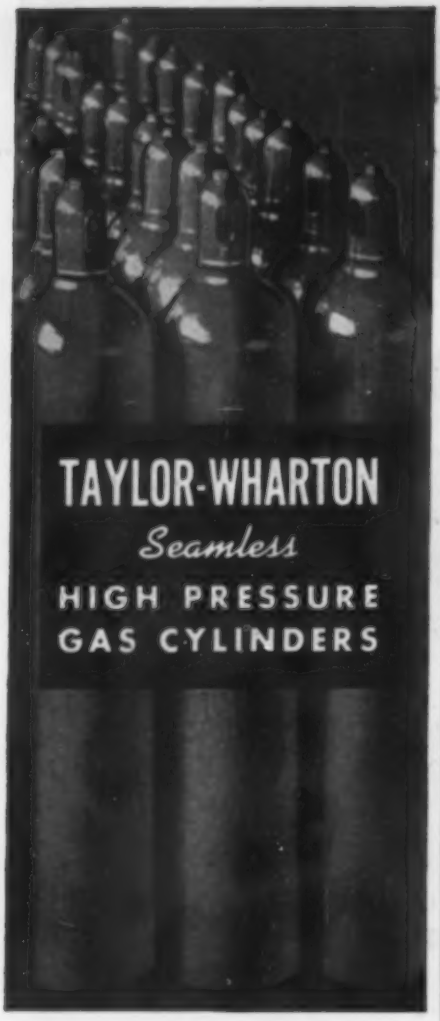
If some saturating, laminating or bonding requirement is giving you trouble, let us help. Our technical staff will be glad to work right along with you to formulate just what you need. Write us today.

FLINTKOTE

Products for Industry

FLINTKOTE INDUSTRIAL PRODUCTS

THE FLINTKOTE COMPANY, *Industrial Products Division*
30 Rockefeller Plaza, New York 20, N.Y. • Atlanta • Boston • Chicago Heights



Prompt service on your needs for

CHLORINE, OXYGEN, HYDROGEN, CARBON DIOXIDE, NITROUS OXIDE, NITROGEN, ETC.

Diameters up to 13"

• All Taylor-Wharton cylinders are made by the reliable "billet" process to the highest standards of manufacturing, testing and inspecting. Bottoms are integral (not spun), wall thicknesses are carefully controlled for uniformity. Complete, modern facilities to meet all your needs as to quantity, types and sizes. Let us quote on your requirements.

Air Reduction Pacific Co. Their names and districts are: L. A. Hamilton, Seattle; E. W. MacCorkle, Jr., Portland; H. W. Saunders, San Francisco; H. A. Hoth, Los Angeles.

U. S. Steel Corp. has appointed Melvin L. Kurtz assistant sales manager of the metropolitan Chicago territory of its subsidiary, Universal Atlas Cement Co.

Hagan Corp., Pittsburgh, has opened a branch office in Denver with W. C. Bennett as district manager.

Hardinge Co., York, Pa., has appointed the Auto-Filtration Co. of Montreal, Canada, sales agent for the Province of Quebec, the Canadian maritime provinces and Newfoundland.

Samuel P. Sadtler & Son, Inc., has opened enlarged laboratories at 2100 Arch St., Philadelphia 3, Pa.

Patterson Foundry & Machine Co., East Liverpool, Ohio, has appointed Ralph F. Cooper, chief engineer. He will be in charge of all the company's mechanical engineering in the plant and in the field.

Allied Chemical & Dye Corp., New York, has appointed Woodward Allen manager of the Charlotte, N. C., branch office of the Solvay sales division. M. S. Johnson succeeds Mr. Allen as manager of the Boston office. H. G. Phillipps, Jr., has been made manager of the Pittsburgh branch office. H. W. Causey and M. F. Kennedy have been appointed assistant manager at Charlotte and Pittsburgh respectively.

Fritzsche Bros., Inc., New York, has announced that Norman Jones has joined their sales staff.

Merck & Co., Rahway, N. J., has appointed Herbert W. McMullen an export sales representative of its foreign sales subsidiary, P.W.R. Export Corp., 161 Sixth Ave., New York.

Heyden Chemical Corp., New York, has purchased the minority interest of the Borden Co. and now owns more than 99 percent of the stock of American Plastics Corp., Bainbridge, N. Y.

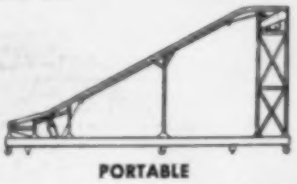
...igan Chemical Corp., St. Louis, ...h., has appointed John G. Collins ...ral sales manager.

...met & Hecla Consolidated Cop... Co., Detroit, has elected the fol...ing vice presidents: A. E. Peter...nn, general counsel; H. Y. Bassett,

THIS STREAMLINER
30° INCLINED
BELT CONVEYOR

SPEEDS
FLOOR-TO-FLOOR
MATERIALS HANDLING

It operates either up or down at a constant speed of 45 feet per minute. Rollers can be "SET HIGH" for oversized packages, or "SET LOW" to provide a protective guard rail on both sides of the conveyor. Unit, available in standard sizes up to 30" wide, has durable, rough top rubber belt . . . a manual take-up for belt slack . . . may be equipped with free-rolling casters for portability . . . or can be supported from one floor. Write for detailed information today.



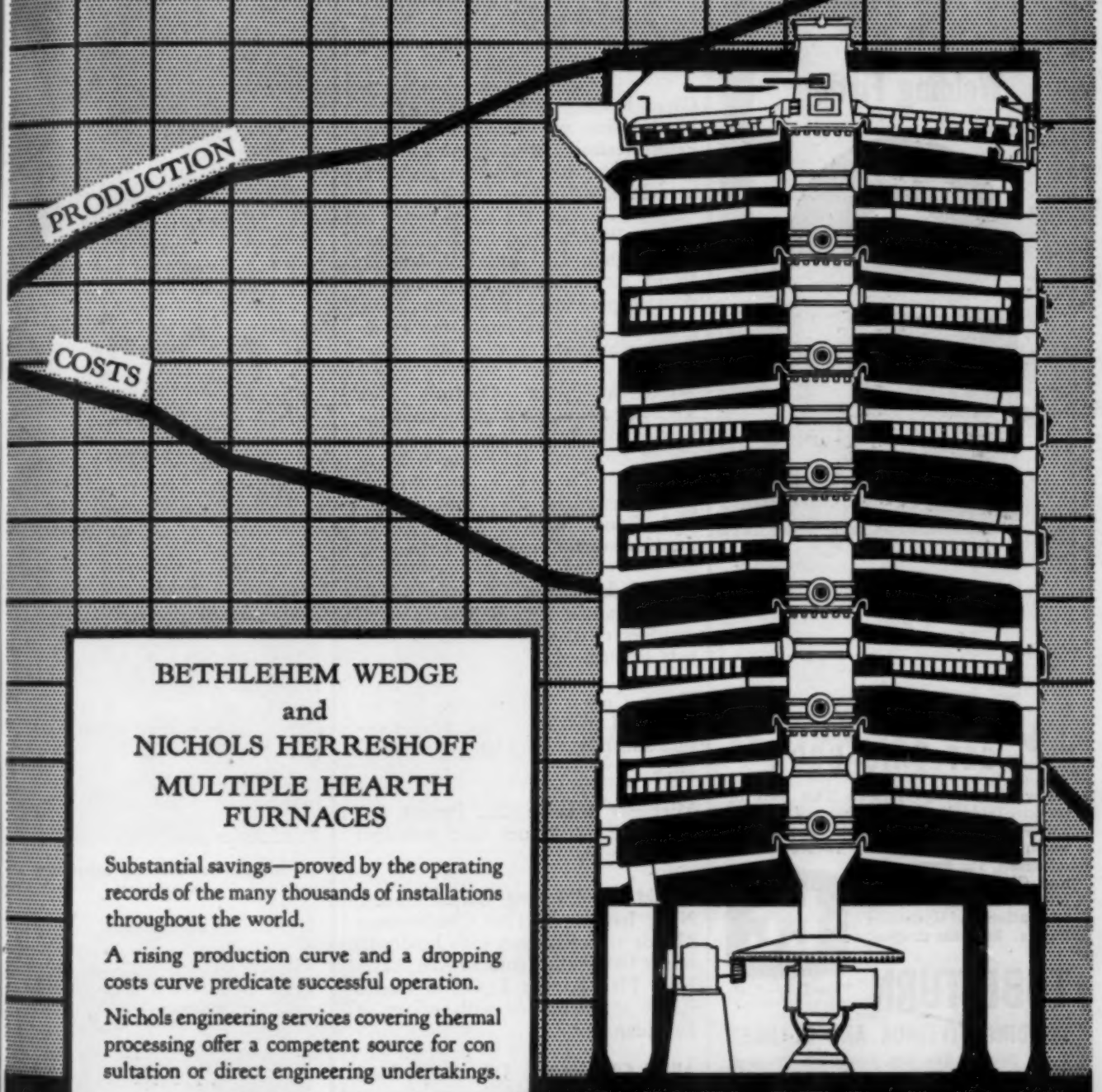
PORTABLE

SUPPORTED FROM ONE FLOOR

Our more than 25 years' experience is at your service to help you solve your materials handling problems.

HARRY J. FERGUSON CO.
WHEEL • PORTABLE BELT • BELT AND ROLLER GRAVITY CONVEYORS
117 WEST AVE., JENKINTOWN, PENNA.

IMPROVED PERFORMANCE
At Lower Cost



BETHLEHEM WEDGE
and
NICHOLS HERRESHOFF
MULTIPLE HEARTH
FURNACES

Substantial savings—proved by the operating records of the many thousands of installations throughout the world.

A rising production curve and a dropping costs curve predicate successful operation.

Nichols engineering services covering thermal processing offer a competent source for consultation or direct engineering undertakings.

Write for bulletins.

NICHOLS ENGINEERING & RESEARCH CORPORATION
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University Tower Bldg., Montreal, Canada

HOW STRONG?

is a

Welding Fitting

GET THIS BOOK

Allowable Working Pressures: This book of pressure tables is a real working tool. Covers Tube-Turn welding fittings in all sizes, all weights, and all regularly manufactured materials, for Power, Oil and Chemical Process, District Heating, Gas, Refrigeration, and Hydraulic Piping. Mail the coupon.

TUBE-TURN

TUBE-TURN—*T. M. Reg. U. S. Pat. Off.*

WELDING FITTINGS AND FLANGES

District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

Tube Turns, Inc., Dept. 2304, Louisville 1, Kentucky

Please send "Allowable Working Pressures" book.

Name.....

Position.....

Firm Name.....

Street.....

City.....*Zone*....*State*.....

general manager of the Wolverine Tube division, and A. H. Wohlrab, general manager of the Calumet division.

Vapor Recovery Systems Co., Los Angeles, has appointed L. S. Curfew, executive vice president; J. F. Lee, general manager; and G. F. Denny, chief engineer.

Pittsburgh Plate Glass Co., Pittsburgh, has made Robert O. Boden development director, a new position in the personnel department.

Glyco Products Co., Inc., Brooklyn, N. Y., has appointed Franklin T. Peters, technical service representative to consult with industrial chemical users in northern New Jersey.

E. I. du Pont de Nemours & Co., Inc., Wilmington, has made William H. Ward, general manager of the explosives department, a director, vice president and member of the executive committee.

Robertshaw-Fulton Controls Co., Knoxville, Tenn., has announced the merger of Robertshaw Thermostat Co., Youngwood, Pa.; Fulton Sylphon Co., Knoxville, Tenn.; and Bridgeport Thermostat Co., Inc., Bridgeport, Conn. John A. Robertshaw is president of the new organization.

Eagle-Picher Sales Co., Cincinnati, has appointed G. A. Cowan sales manager of the new Celatom products department.

Darco Corp., Wilmington, has appointed Louis M. Gill general manager and Edgar W. Harris director of sales.

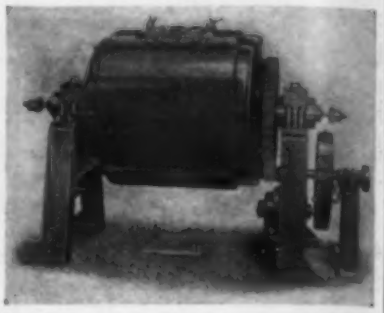
Michigan Abrasive Co., Detroit, has elected F. P. Hauck vice president and director.

Liquid Conditioning Corp., Linden, N. J., has named Tom Charbonneau Florida representative with headquarters at 105 South Kentucky Ave., Lakeland, Fla., Ramon I. Gil is Puerto Rican representative with offices at San Juan.

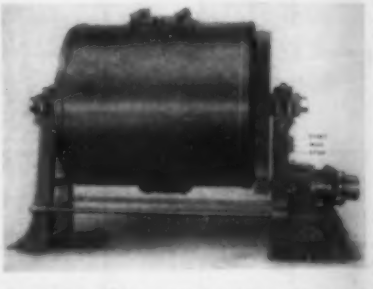
Allied Chemical & Dye Corp., New York, has made the following changes in the branch office organization of the Solvay sales division. Woodward Allen has been appointed manager at Charlotte, N. C., covering the southeastern territory. M. S. Johnson succeeds Mr. Allen as manager of the Boston office.

American Cyanamid Co., New York, has appointed Cameron Mackenzie as a sales representative in the New York

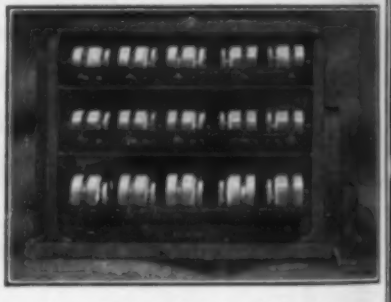
PAUL O. ABBÉ GRINDING AND MIXING EQUIPMENT



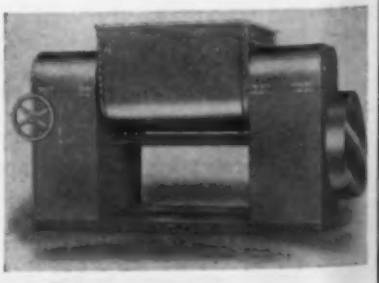
No. 6—Jacketed Steel Ball Mill with Silent Chain and Motor Drive.



No. 3C—Pebble Mill with "Compack" —motor drive.



No. 15—Jar Mill for laboratory experiments.



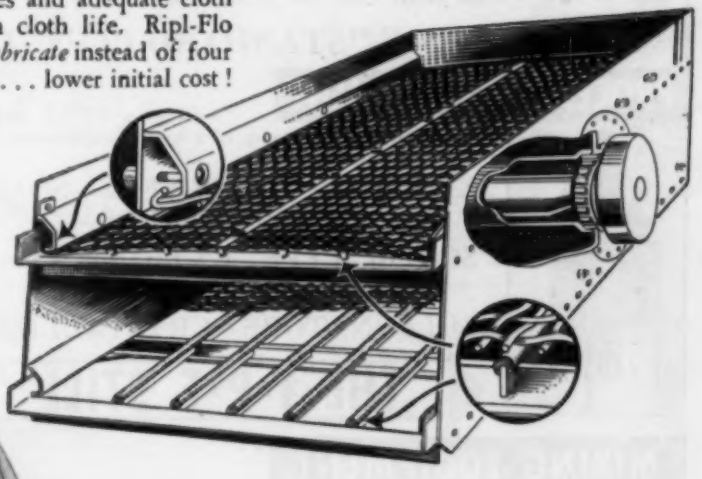
No. 6—Mass and Paste double-arm Mixer.

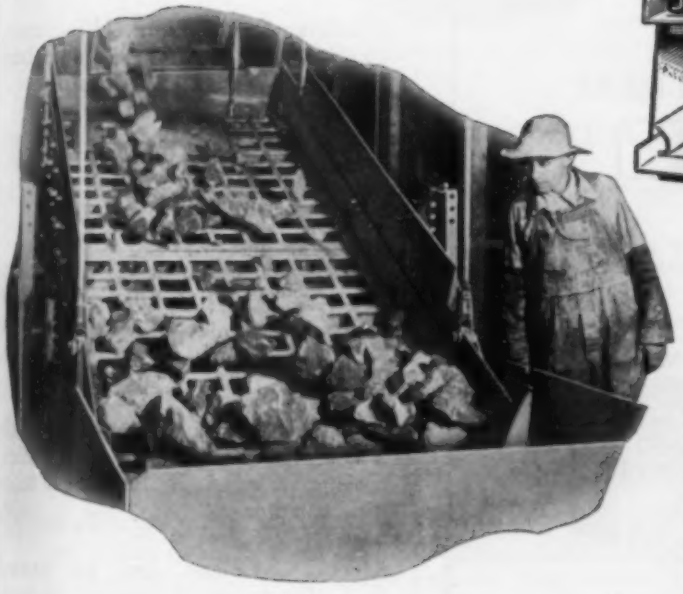
PAUL O. ABBÉ

of Little Falls, New Jersey
375 Center Avenue

"Two Main Things I want to know about Any Vibrating Screen!"

1. HOW IT'S BUILT: Take a close look at Ripl-Flo screen if you want to see long-life construction! Made of high strength alloy steel with all welded parts "stress-relieved" for durability. Accurately crowned support frames and adequate cloth supports greatly increase screen cloth life. Ripl-Flo screen has only *two bearings to lubricate* instead of four — less weight and maintenance . . . lower initial cost!





2. HOW IT WORKS: If you could watch a Ripl-Flo screen run you'd see a very rapid stratification and an *even* bed depth of material. Eccentric mechanism imparts a *balanced* circle throw motion to *every part* of screen surface. Every Ripl-Flo screen is tested before shipment for correct balance, throw, bearing temperature. You can change screen surfaces easily . . . because clamping plate adjustment is located *outside* of screen body!

• Ripl-Flo vibrating screens are built by Allis-Chalmers in 15 sizes from 3 x 6 to 6 x 16 ft, with one, two or three decks. Their use has resulted in *more profitable operations* in screening a wide range of materials. Send for Ripl-Flo Bulletin 07B6151B. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2375

RIPL-FLO SCREENS

Combine Sound Engineering with Proven Performance!

Ripl-Flo is an Allis-Chalmers Trademark

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

What Are Your PROCESSING NEEDS

STANDARD EQUIPMENT? SPECIAL UNITS? COMPLETE PLANTS?

I•P•E *Furnishes All Three*

—backed up with experienced engineering skill, expert design and precision manufacturing.

I•P•E's "standard-plus" line has progressed beyond the accepted meaning of the word "standard." Every equipment item was special when originally designed—built to meet specific needs—and now is included in—

THE I•P•E "STANDARD-PLUS" LINE

PROCESSING EQUIPMENT

—Order a STILL and you'll get the outstanding advantages of a special engineered job. This is also true for I•P•E

KETTLES—DISSOLVERS—SOAP and GREASE CRUTCHERS—
SCREW TYPE EXTRUDERS—NITRATORS
SULFONATORS—CRYSTALLIZERS

THE I•P•E STILL

MIXING EQUIPMENT

—Here's a mixer developed for use with materials having the tendency to lump—a special job that is now "standard-plus." Other I•P•E mixers with outstanding features are

CONTINUOUS MIXERS—PASTE MIXERS—CONICAL DRY MIXERS—DOUGH MIXERS—REDUCING MIXERS

I•P•E HORIZONTAL JACKETED MIXER

AGITATORS

—There's an I•P•E agitator for every mixing need—TURBINE TYPE—PADDLE TYPE—VERTICAL FINGER TYPE—PROPELLER TYPE—ANCHOR TYPE—RIGHT ANGLE VERTICAL AGITATOR DRIVE.

THE I•P•E SIDE ENTERING PROPELLER AGITATOR

SPECIAL UNITS AND COMPLETE PLANTS—I•P•E staff of process plant analysts, engineers and designers welcome your inquiry for special needs. No obligation.

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—ENGINEERS
—DESIGNERS
—MANUFACTURERS

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metropolitan district for their Calco chemical division.

Bowser, Inc., Fort Wayne, Ind., has purchased outright the entire liquid processing division of Buckeye Laboratories Corp. of Cleveland.

Pennsylvania Salt Manufacturing Co., Philadelphia, has appointed Thomas W. Cox assistant secretary of the company.

C. Lee Cook Manufacturing Co., Louisville, Ky., has announced the association of T. F. Hudgins with its midcontinent agent, the Woodbank Machinery Co., Tulsa, Okla.

E. I. du Pont de Nemours & Co. has appointed R. E. Troutman West Coast sales manager with headquarters in Los Angeles. He succeeds Joseph Shrawder, Jr., who has become manager of technical sales in Wilmington.

High Vacuum Coating Corp. has elected Paul W. Lawler to the board of directors.

O'Sullivan Rubber Corp., Winchester, Va., has appointed V. R. Childress manager of industrial plastics sales.

American Brake Shoe Co. has appointed J. Robert Pauline works manager for the Kellogg division in Rochester, N. Y.

Edward Valves, Inc., East Chicago, Ind., has appointed Charles H. Tate Co., Cleveland, as their representative for northern Ohio and Erie County, Pa.

St. Regis Paper Co., New York, which is consolidating its forestry activities, has appointed A. B. Recknagel technical director.

Kinetic Chemicals, Inc., has named R. J. Thompson as director of sales. He succeeds W. W. Rhodes who has been made sales manager in charge of aerosol propellants.

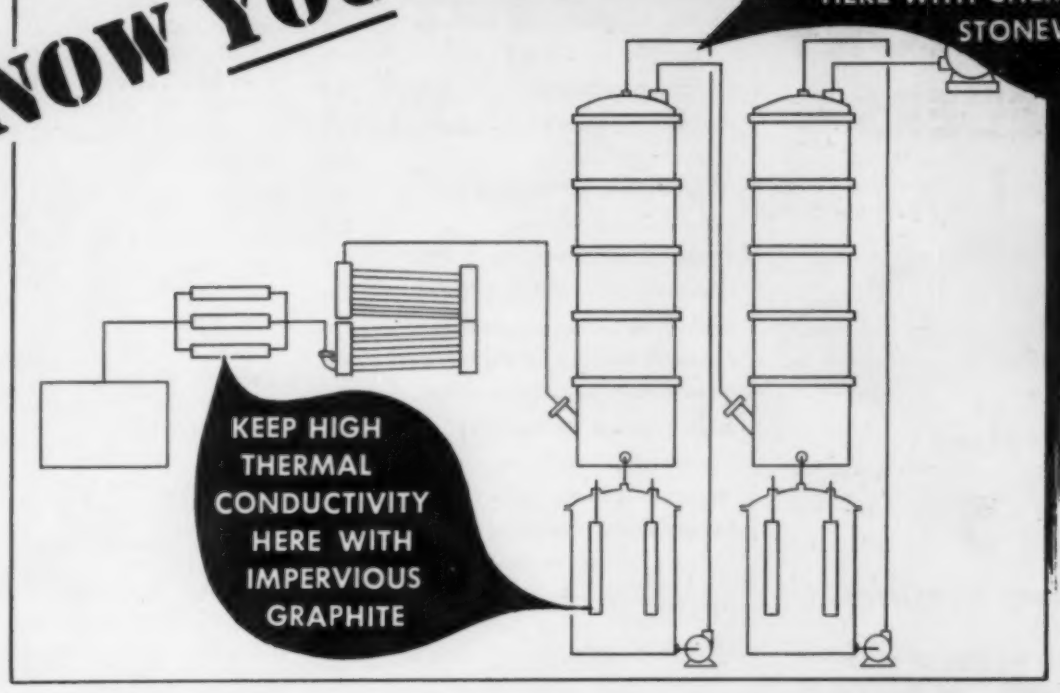
Pittsburgh Plate Glass Co. has added L. W. Piester to its staff of chemical engineers in the development at its Columbia Chemical division at Natrium, W. Va.

Petroleum Specialties Co., St. Louis, Mo., has appointed Oscar H. Fager general manager.

Allis-Chalmers has named George H. Carden and T. G. Smith respectively manager of the Baltimore district office and resident representative at Beaumont, Tex.

NOW YOU CAN...

BEAT CORROSION HERE WITH CHEMICAL STONEWARE



KEEP HIGH THERMAL CONDUCTIVITY HERE WITH IMPERVIOUS GRAPHITE

Combine the individual properties of Chemical Stoneware and Graphite . . . with all equipment from One Source!

"Shopping around" for the right combination of process plant equipment is now a has-been. To meet the tightest demands for corrosion resistance, shock resistance, and thermal conductivity . . . General Ceramics is now prepared to supply equipment fabricated *in whole or in combination* from both Chemical Stoneware and Falls Impervious Graphite.

This means: the extreme *corrosion proof* properties of chemical stoneware to all acids except hydrofluoric . . . *plus* the high heat transfer, thermal and mechanical shock resistant properties of Falls Impervious Graphite, economically combined where each is most needed in *one* process—planned and installed by *one* company, General Ceramics.

Write for complete information, or outline your requirements for specific recommendations and a proposal.

STANDARD EQUIPMENT

Chemical Stoneware:
- Centrifugal Pumps
- Exhausters
- Pipes, Fittings, Cocks
- Gas Coolers
- Towers
- Jars, Tanks, Vessels

Falls Impervious Graphite:
- Plate Heaters
- Heat Exchangers
- Pipe and Fittings

and get BOTH FROM HERE

GENERAL CERAMICS AND STEATITE CORPORATION CHEMICAL EQUIPMENT

General Ceramics AND STEATITE CORP.

CHEMICAL EQUIPMENT DIVISION • KEASBEY, NEW JERSEY

BUFFALO: 220 Delaware Ave.
CHICAGO: 20 N. Wacker Drive
LOS ANGELES: 415 So. Central Ave.
PORTLAND 5, ORE: 410 New Fliedner Bldg.
SEATTLE: 1411 Fourth Ave.
TACOMA: 417 Tacoma Bldg.
SAN FRANCISCO: 598 Monadnock Bldg.
PITTSBURGH: 412 Peoples Gas Bldg.
MONTREAL: Canada Cement Bldg.
TORONTO: Richardson Agencies, Ltd., 454 King St., West
VANCOUVER, B. C.: Willard Equipment Ltd., 860 Beach Ave.

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In addition to the manufacturing facilities of the Chemical Equipment Division those of the Insulator Division are also available for handling ceramic problems in all branches of industry. General Ceramics & Steatite Corporation is therefore able to offer service covering all industrial applications of ceramic products.

SYNTRON

"Vibra-Flow"

VIBRATORY FEEDERS

Have

5

Distinct Features–

1. Handle a range of materials from light, fine powders to heavy, coarse ores.
2. Provide variable control of material flow.
3. Have no moving, wearing mechanical parts.
4. Available in a variety of trough styles, flat pan, tubular, grizzly, spreader, etc.
5. Capacities of from a few pounds to 500 tons per hour.

THAT WILL INCREASE YOUR MATERIAL HANDLING EFFICIENCY

An illustrated folder is available, or—if you'll send us the details of your problem—description of material to be fed, maximum feed per hour, desired length of trough, etc.—our Engineering Department will be glad to submit their recommendations.

SYNTRON CO.
610 Lexington
Homer City, Pa.

CONVENTION PAPER ABSTRACTS

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Cheap Oxygen

OXYGEN on a mammoth tonnage basis nears reality in the U. S. today with two large plants now under construction, capable of producing 1,600 tons of oxygen per day, and many more such plants being planned.

The equipment necessary to accomplish this increased oxygen manufacture is a regenerator, a type of heat exchanger which consists of a shell or vessel filled with packing material.

When the regenerator is in operation, the fluid which is to yield heat first passes through the bed of packing, storing up heat in the packing material. After a suitable interval, the flow is diverted to a similar vessel. The heat stored in the packing is then given to a heat-transfer fluid.

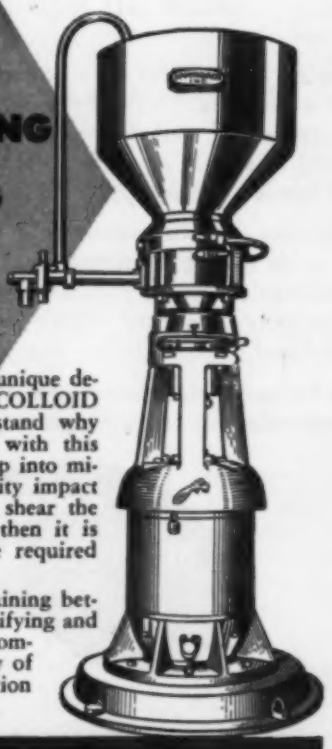
In this way we have an indirect transfer of heat from one fluid to another by an intermittent process instead of the direct transfer that occurs continuously in the recuperative type of exchanger. By having two regenerators, one storing heat and the other giving it up at the same time, the heat exchange can be carried out in a continuous manner.

Another advantage of the regenerators in a low temperature process is that they serve as air purifiers while performing their heat exchange functions, thus eliminating expensive chemical processes to treat the air for purification purposes.

Instead of twenty tons per day from

FOR Better

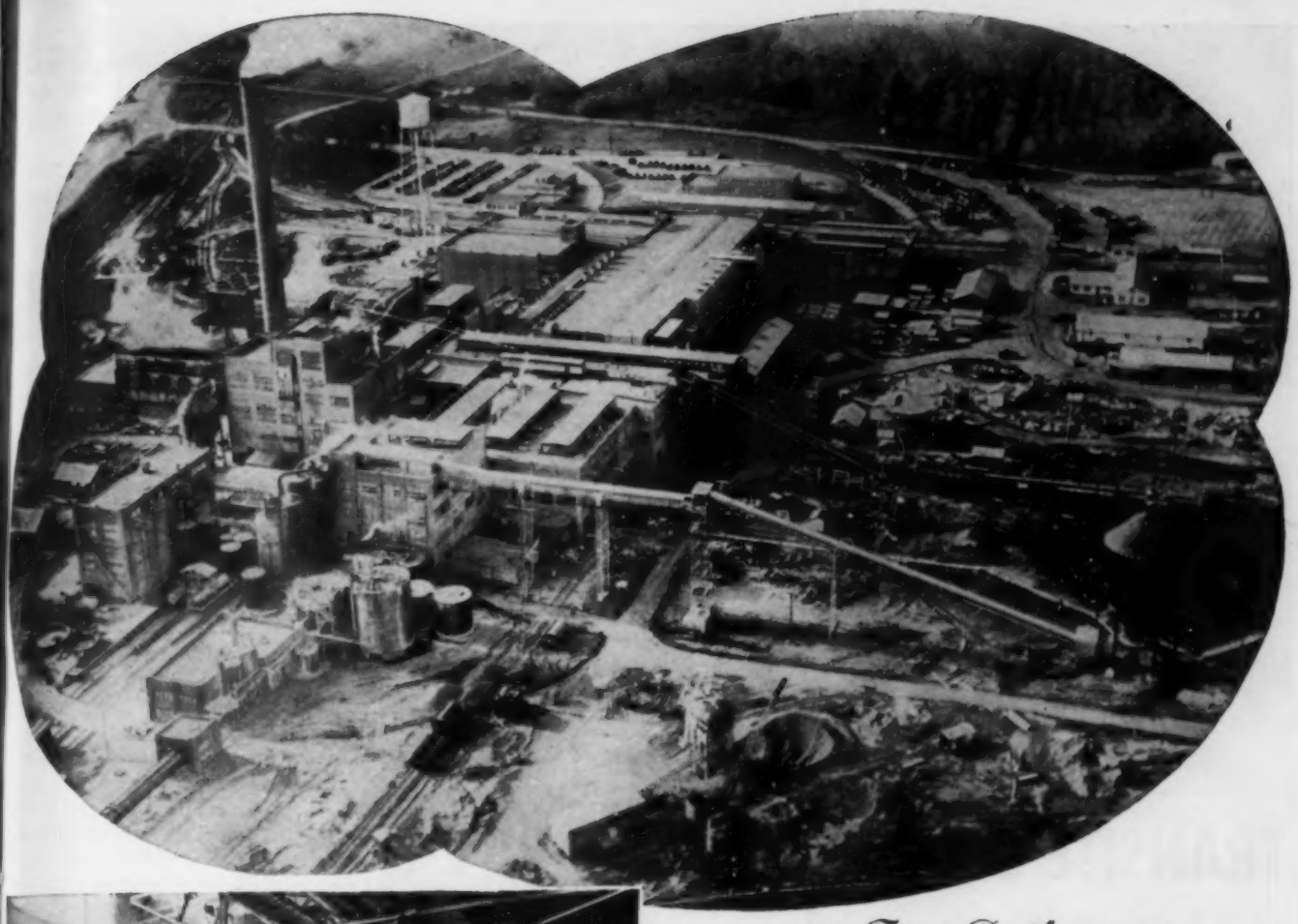
HOMOGENIZING
EMULSIFYING
GRINDING

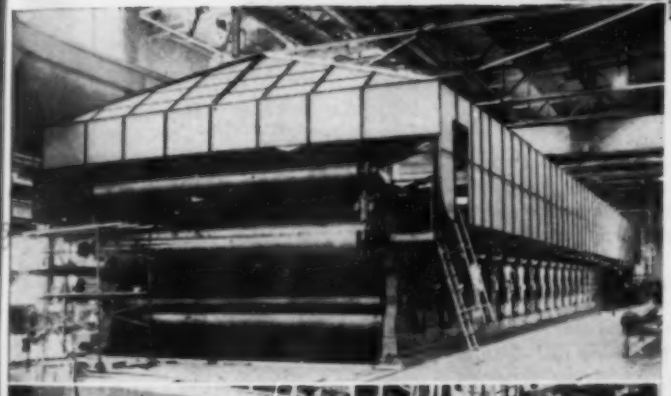


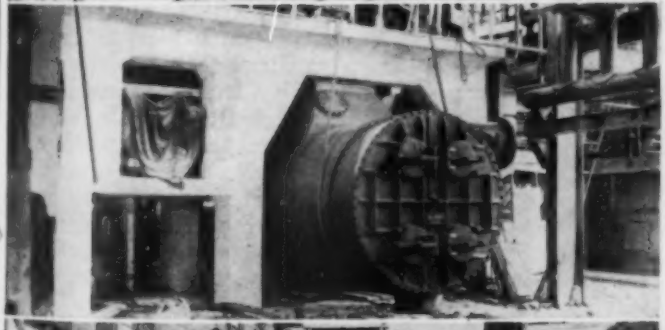
When you examine the unique design of an EPPENBACH COLLOID MILL, it is easy to understand why finer diffusion is obtained with this machine. Liquid is broken up into minute globules by high velocity impact . . . rotor and stator teeth shear the material mechanically . . . then it is hydraulically sheared to the required particle size.

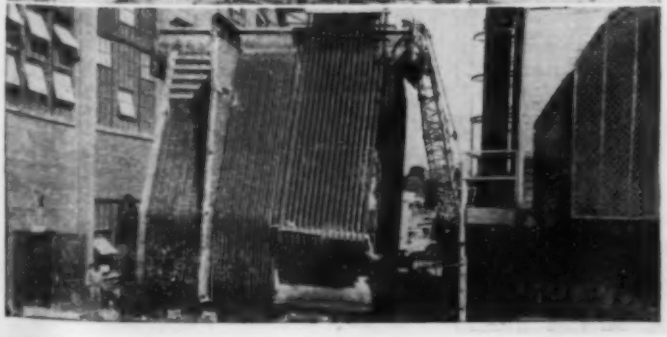
If you are interested in obtaining better results in grinding, emulsifying and homogenizing, write for complete details. Ask for a copy of Catalog No. 401. No obligation of course.

EPPENBACH INC.
Processing Equipment for Over 30 Years
44-02 11th Street Long Island City 1, N. Y.









175 Tons Daily X 2

=350 Tons Daily

At the Southland Paper Mills at Lufkin, Texas, Brown & Root, Inc., was given the problem of doubling the newsprint output, which was 175 tons daily.

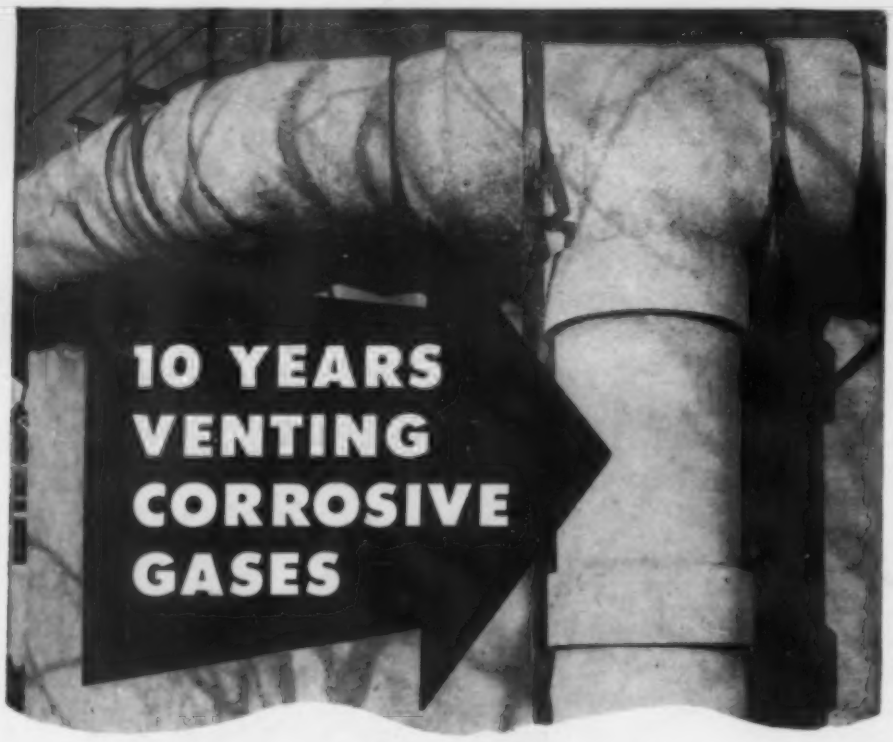
how to multiply a paper mill by 2

Doubling the production involved very substantial increases in power output, expansion of existing buildings, construction of new buildings, installation of new machinery, moving of old facilities, work of every type—and all the time the manufacture of critical newsprint has to be continued at capacity.

Bring your complicated expansion or new construction problems to Brown & Root, Inc., whose resources and experience in the Southwest are unsurpassed.

BROWN & ROOT Inc.

Box 2634 Houston, Texas



. . . and this duct of

TRANSITE INDUSTRIAL VENT PIPE

has never required maintenance

TEN YEARS AGO, the operators of the Dunellen, Plainfield and North Plainfield (N.J.) joint sewage disposal plant faced a serious maintenance problem. Every eight months, the duct carrying corrosive gases from the sludge-drying chambers had to be replaced. Then this plant installed the Transite Duct shown above . . . and in 10 years not one cent has been spent for maintenance.

Strong and durable, Transite Industrial Vent Pipe successfully resists many of the corrosive gases, vapors and fumes met in industrial operations . . . provides effective and economical venting service in a wide variety of industries.

You can use this asbestos-cement pipe outdoors or indoors, for it is rustproof and weather resistant . . . needs no painting. Light in weight and readily assembled, it comes in 19 sizes from 2" to 36" in diameter . . . with a full line of Transite fittings to assure corrosion-resistance throughout the system.

Data Sheet DS-336 gives full details and is free on request. Address Johns-Manville, Box 290, New York 16, New York.

JM PRODUCTS

Typical industries in which Transite Industrial Vent Pipe is used

Aircraft	Dairy	Gas	Petroleum	Shipbuilding
Automobile	Drug	Glass	Potash	Shoe
Baking	Electrical	Laboratory	Pulp & Paper	Smelting
Bleaching	Explosive	Laundry	Quarrying	Soap
Boiler Works	Farm Machinery	Leather	Railroad	Soft Drink
Brewing	Food	Meat Packing	Rayon	Sugar Refining
Canning	Foundry	Metal	Refrigeration	Textile
Ceramic	Furnace	Mining	Rubber	Tool
Chemical	Furniture	Paint	Sewage Works	Water Works

Johns-Manville
TRANSITE Industrial Vent PIPE

a single plant, between 1,000 and 2,000 tons are needed. Instead of costing $1 or more per 1,000 cu. ft. the oxygen should cost not more than about 12 c. per 1,000 cu. ft.

Progress toward this goal has been slow. All the principles for cheap oxygen production on a tonnage scale have been known for at least 25 years but the incentive was never strong enough to develop the large items of equipment necessary.

B. F. Dodge and G. Lund, Yale University, before Division of Industrial and Engineering Chemistry, American Chemical Society, Chicago, Dec. 30, 1947.

Natural Rubber Will Be Supplanted by Synthetic

A CONSIDERABLE additional amount of fundamental work must be done in a reasonably short time if the natural rubber producers are to stay in business. Synthetic rubber has already equalled natural in a number of important aspects and now threatens to pull abreast of it in other properties. If past competition between other natural and synthetic products is any guide, the natural product can only retain its superiority by continued improvement.

The synthetic rubber industry is spending more than 1 percent of its total sales income on research, whereas the Malayan natural rubber research budget is less than 0.4 percent of sales. Larger appropriations for research will be necessary to keep natural rubber competitive with its man-made counterpart.

E. M. McColm, United States Rubber Co., before Chemical Institute of Canada, Toronto, Jan. 20, 1948.

. . . But Not by GR-S

WE MAY as well recognize the unpalatable fact that by every indication, both from our own work in this country, and from what we know of the German's work, it is unlikely that the GR-S type of rubber will ever be entirely competitive. It is probable that the competitor for natural rubber must come from the new, undeveloped fields of polymer chemistry, while GR-S takes its place as just another obsolete weapon of the late war.

R. P. Dinsmore, Goodyear Tire & Rubber Co., before the Chemical Engineers' Club, Washington, D. C., Jan. 13, 1948.

The Danger From Plutonium Is Not From Ingestion

PLUTONIUM, the violently radioactive element of which atomic bombs are made, can be swallowed in small amounts with virtually no ill effects. Recent laboratory tests indicate plu-

"International"

RIBBON MIXERS
Belt or Motor Driven.
MIXERS AND KETTLES
Complete with Tank and Drive Unit in various types and sizes, with any style stirrers, propellers or turbine.
PERMANENT AND PORTABLE MIXERS
SIDE ENTRANCE MIXERS
½ to 25 H. P. Sizes; Repacked from outside.
DRY BLENDERS,
BALL AND PEBBLE MILLS

CATALOG
On Mixers, Agitators, Blenders, Ribbon Mixers, etc., No. 110. Now ready.
CATALOG No. 85 on BALL MILLS—Either catalog or both sent on request.

INTERNATIONAL ENGINEERING INC.

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MORE STRENGTH.
MORE QUALITY...
MORE SERVICE...

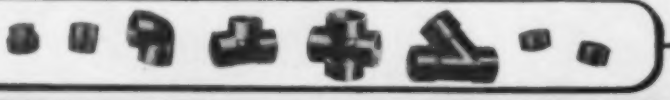
3 REASONS WHY LADISH
Controlled Quality
FORGED STEEL Screwed and
Socket Welding FITTINGS
Save Money in any Piping System . . .

10 MARK PROGRESS

DROP FORGED for dependability
METALLURGICALLY CONTROLLED for quality
ADEQUATELY STOCKED for prompt service

- *Complete Line of Screwed and Socket Welding Fittings*
- *Full Range of Sizes from ⅛ inch through 4 inches*
- *Pressure Ratings from 2000 through 6000 pounds*
- *Carbon, Stainless and Alloy Steels*

Write for Catalog, Volume 2, Today



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CLEVELAND • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES
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tonium is extremely poorly absorbed from the intestinal tract, which means that only slight exposure can occur to workers who may, in the course of their work, swallow small amounts of it.

W. H. Langham, Los Alamos Scientific Laboratories, before a technical conference of the Chicago Section, American Chemical Society, and American Association for the Advancement of Science, Chicago, Dec. 26, 1947.

Radioactive Rhenium Pleases Scientists

ALTHOUGH modern nuclear theory predicted that either rhenium or its sister element osmium must be radioactive, scientists heretofore have been unable to detect any activity in either. This cast doubt on science's concept of the nucleus of the atom.

Better and more sensitive methods of measuring radioactivity were applied to rhenium in a recent investigation which made a small but vital contribution to the knowledge of the atom. Rhenium, a metallic element akin to platinum, is naturally radioactive.

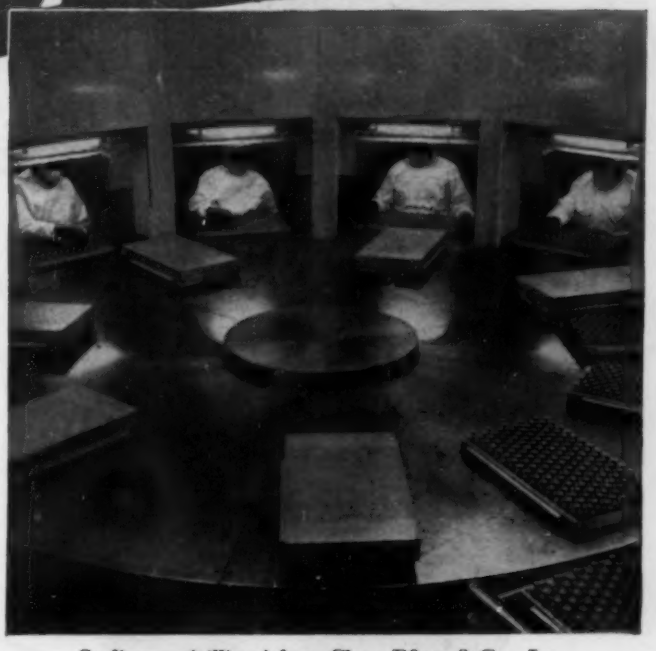
W. F. Libby and E. C. Anderson, University of Chicago, before a technical conference of the Chicago Section, American Chemical Society, and American Association for the Advancement of Science, Chicago, Dec. 26, 1947.

Make Mine Market Research

THE chemical industry presents an interesting paradox. For many years this industry has been the foremost champion of product research, but in the matter of conducting marketing research it has not been so progressive. The results of a survey among 25 of the leading middle-size companies manufacturing chemical products were published in 1945. Of these only one company had an established market research department. Five others considered marketing research the job of the sales department, and the remainder of the companies assigned these duties to the technical department or depended on the sales department's opinions, which were chiefly hunches.

If the results obtained in this survey are representative it would seem that chemical companies are not placing proper emphasis on the distribution phase of their business. Economists and market researchers are of the opinion that we are about to enter one of the most competitive eras this nation has ever known. It seems foolish for a company to enter the battle unprepared by neglecting the phase of its business which may ultimately become the most important. Such a procedure, moreover, is thoroughly at odds with the progressive attitude

LECTRODRYER holds humidity at 12% IN PFIZER WORKROOMS



Sealing penicillin vials at Chas. Pfizer & Co., Inc.

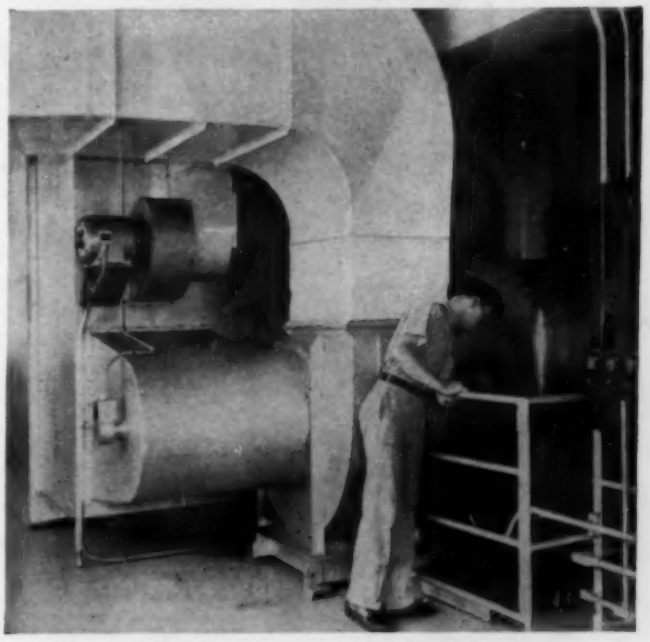
A constant low humidity is vital to operations centering around the production of penicillin, streptomycin and similar drugs. That's why Chas. Pfizer & Company, Inc. takes such care to exclude moisture from workrooms like that pictured here.

Air from the rooms served by this CHX Lectrodryer is constantly recirculated through this DRYing machine, holding it at 12% relative humidity. About 5% make-up air is added. Action of the machine is automatic, with fresh beds of Activated Alumina being brought into the air stream every few minutes, while others go out of service for reactivation.

Have you a problem in DRYing? Our engineers will recommend equipment to handle the job, calling on many years of experience to advise you. Lectrodryers are DRYing air, gases and organic liquids in thousands of plants all over the world.

For this DRYing help, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sidney.



A 20,000 cubic-foot area is served by this CHX Lectrodryer.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

REGISTERED TRADEMARK U.S. PAT. OFF.

Inter-batch uniformity

. . . a vital step in manufacturing RAYON

Flattering hosiery from thermoplastic chips . . . a manufacture requiring a uniformly mixed product. Towering 360 cu. ft. mixers fulfill this exacting need by continuously blending individual mixes into one homogeneous stock.

Sprout-Waldron Vertical Mixers Offer:

- minimum floor space
- low power consumption
- inter-batch reservoir

From glue flakes to organic dyestuffs . . . Sprout-Waldron vertical blenders are proving their worth in widely diversified industries. Capacities range from 10 to 375 cu. ft. Construction features and materials meet individual installation requirements . . . from stainless steel to Plexiglas.

If you mix, reduce, separate, or handle material in bulk, consult Sprout-Waldron. Our valuable ADAPTIONEERING service — ingenuity + machines + experience — is at your command.

SPROUT WALDRON
Manufacturing Engineers

which most chemical companies have toward product research.

The problem of market measurement for many chemicals is a complicated one. For a number of them, the market is a broad horizontal one. One chemical, for example, may be used in varying quantities by different industries. The measurement problem is further complicated by the fact that the chemical industry is one of the biggest consumers of its own products. These facts render many of the published statistics inadequate as a guide to market demand.

Determine the estimate of total market by industries and by regions. It is a simple matter to break down the company sales into the same category and by a series of simple divisions obtain the company share of market by industry, by region. The variation in share of market by industries and by regions comes as a great shock sometimes to sales executives who, up to that time, believed they were well informed.

A number of the more progressive market researchers are carrying this form of analysis one step further. They are making an analysis of their consumers' business.

Another important job for marketing research is the determination of prices paid for a product by consumers and the variation by company by region. An analysis of competition, indicating the principal competitors and their ranking, in terms of volume salewise, by markets is an invaluable aid to sales management. Another important function of marketing research is the determination of the most efficient channels of distribution through which the product should move.

These data can be used as a basis for: (1) Planning production, (2) providing a factual basis for planning purchasing program, (3) locating of plants, warehousing and storage facilities, (4) determining sales quotas by territories, (5) determining number of salesmen required, most efficient sales territory size, and evaluation of salesmen's compensation, (6) distributing advertising and sales promotion efforts most efficiently, (7) improving marketing methods, procedures, and policies.

H. J. Vogler, Day & Zimmermann, before Purchasing Agents Association of Wilmington, Delaware, Sept. 29, 1947.

A New Wrinkle in Wrinkleproofing

CHEMISTS have discovered why garments wrinkle. Wrinkles in clothing are attributed to the "personality" of the individual fibers. Any fabric's resistance to stretching de-

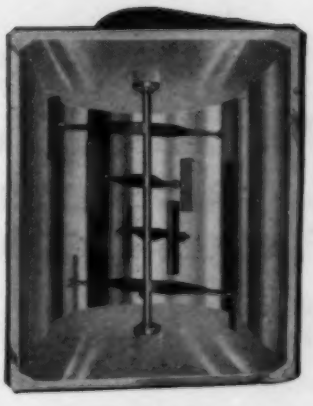
Another step forward in chemical processing

THE NEW "CHR" JACKETED
SAN-I-TANK
HAS THESE ADVANTAGES
1. GREATER CAPACITY IN LESS SPACE
2. STAINLESS STEEL WELDED CONSTRUCTION
3. GUARANTEED AGAINST RUST AND CORROSION
4. BUILT LOW FOR FAST, CONVENIENT OPERATION
5. SMOOTH, HIGHLY POLISHED INTERIOR
6. NO PROTRUDING COILS
7. EFFICIENT MULTIPLE MIXING PADDLES
8. SPECIAL HIGH-PRESSURE JACKET

The CHR San-I-Tank is an entirely new design in jacketed tanks for processing liquid chemicals; either cooking or cooling. Operation is simple, convenient and fast . . . production is increased. The special construction of the jacket which is welded directly to the inner tank permits maximum "flooded-surface" contact. Tests have proven that a full tank of light liquid can be brought up to boiling within the short time of thirty minutes. Two inches of permanent glass-wool insulation prevent heat loss between the inner and outer shell of the tank and protect the operator.

At the right is a top view of the CHR Tank showing the smooth, highly polished stainless steel interior. There are no coils to clog or collect unsanitary waste. A series of eight heavy duty mixing paddles are arranged to speed processing by constantly agitating the liquid against the heated tank jacket. Scraper blades on the paddles prevent the mixture from sticking to the tank walls. CHR Jacketed Tanks are also available with propeller type agitator for mixing light chemicals.

Investigate this new tank before you buy. Send today for complete information.



THE FINEST EQUIPMENT FOR CHEMICAL PROCESSORS

Type CJ Stainless Steel Jacketed Tank is a new, proven development for rapid cooking and mixing of liquid products. Tanks are equipped with vibrationless Rotary Seal Agitators. Working Capacities from 60 to 1,000 gallons.

These sturdy, stainless steel Stock Pots will give you a lifetime of use. They are guaranteed rustproof and noncorrosive and can be equipped with stainless steel nipples, covers and casters. Stock Pots come in 5, 10, 20, 30 and 50 gallon capacities.

STAINLESS STEEL SAN-I-TANKS

SERVING THESE INDUSTRIES: BEVERAGE • MILK • FOOD • DRUGS • CHEMICALS • COSMETICS

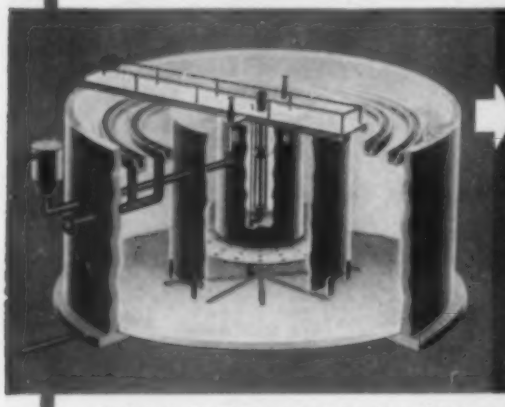
METAL GLASS PRODUCTS COMPANY

GENERAL OFFICES BELDING 2, MICHIGAN

the CLARIFLOW

WITH INDEPENDENTLY-OPERATED MIXING, FLOCCULATION, STILLING AND SEDIMENTATION ZONES

A notable improvement over conventional short-retention water treatment units. Its control over short-circuiting, control over each function and control of sedimentation through low weir rates mean improved effluent . . . higher filtration rates . . . longer filter runs . . . better industrial waste recovery and treatment.



WRITE FOR BULLETIN 656

FOR
- WATER SOFTENING
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PORTABLE MIXER

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The New TERRISS 3-Speed Portable Mixer is an all-around unit that will take care of all your mixing, blending and agitating problems. If your tank or vat is below floor level the TERRISS 3-Speed Mixer will reach down and do a real job for you. If your container sits on the floor, a little adjustment and the mixing begins. If your tank or container is high off the floor, the TERRISS Mixer will lift up and do the mixing job. All parts that touch your product are Stainless Steel. Standard belt drive permits propeller speeds of 175 RPM, 325 RPM and 575 RPM. Other combinations are available with simple adjustments. Both propeller shaft and stand are adjustable, permitting unlimited settings to fit any job in your plant.

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pends on the fineness of its filaments, the ease with which they are able to move in relation to one another, and their ability to recover from stretching without being permanently deformed.

The research described is important to textile chemists because the mechanism by which wrinkle-proof effects are produced has never been made clear before. The ideas developed as a result of experiments with fabric samples could be applied in the modification of paper and other fibrous materials to make them foldproof.

Fabrics differ from sheet materials such as cellophane in being woven or knitted from yarns consisting of tiny filaments. Partial stretching of the separate filaments is produced by folding, no matter how strong the multifilament character of the fabric may be, but chemical treatments can increase wrinkle resistance.

These chemicals must penetrate into the substance of the filaments or else they become ineffectual deposits on the surfaces and interfere with the movement of the filaments.

Any improvements in the ability of the separate filaments to recover from stretching parallel exactly the improvements in the wrinkle resistance of the fabric.

Materials deposited on the filament surfaces stick them together and made the fabric worse. Substances which lubricate the fiber surfaces enhanced the multifilament character of the fabrics and tended to make them more wrinkle resistant.

I. J. Gruntfest and D. D. Gagliardi, Rohm & Haas Co., before Philadelphia Section, American Chemical Society, Philadelphia, Jan. 22, 1948.

Improved New Paints Are Forecast

RESINOUS materials, the result of water dispersions of vinyl polymers or paint raw materials, adhere sharply to porous surfaces, exhibit a high degree of resistance to corrosion, and remove the use of flammable solvents.

Employment of emulsion or latex finishes appears attractive industrially, since it would employ water to replace flammable solvents and thus eliminate expensive and hazardous solvent recovery systems.

Following two years of tests, the most logical applications of vinyl dispersions are believed to be interior wall finishes, masonry paints, and specialty products where chemical and solvent resistance to vinyl films can be employed advantageously.

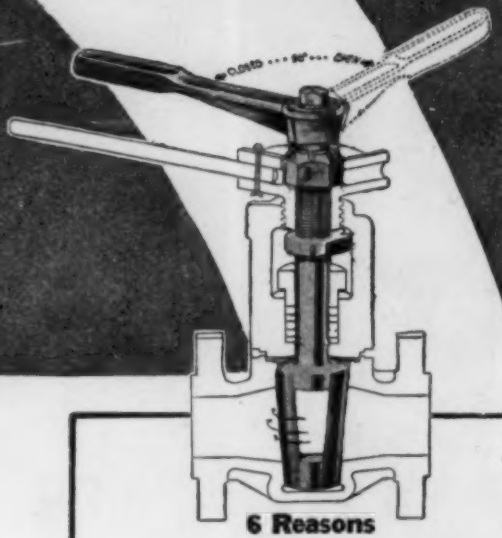
Whereas the vinyl polymers show excellent adhesion to porous surfaces, they cling poorly to metals.

Vinyl polymer films, when properly prepared, are impermeable to gases

Quick Action Every Time

with Homestead Lever-Seald Valves

OPERATE 16 to 28 TIMES FASTER Than Screw-Stem Type Valves



Operation of HOMESTEAD LEVER-SEALD VALVES is quick and positive. From wide-open to fully-closed requires only a *quarter-turn* of the upper lever—and that's 16 to 28 times faster operation than the 6 to 7 full turns required by screw-stem-type valves. Not only do HOMESTEAD LEVER-SEALD VALVES operate quickly, but they are built to operate under all conditions; for built right into every valve is a powerful lever and screw device which relieves seating pressure between the plug and body just enough to overcome friction and permit easy turning. For fast, positive, labor-saving operation, they can't be beat! And the small space required by the Quarter-Turn, permits their use where other valves could not be operated.

HOMESTEAD LEVER-SEALD VALVES are made in combinations of metals and alloys to meet your service requirements, in sizes 1½" to 10", for pressure ranges from 150 pounds to 1500 pounds. Special valves may be designed to meet your specific requirements. Write *now* for Valve Reference Book No. 38.

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Why You Should Use Homestead LEVER-SEALD VALVES:

1. **Instant Stick-proof operation.**
2. **QUARTER-TURN FULLY OPENS OR CLOSES.**
3. **Positive seal without lubrication.**
4. **Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.**
5. **Unobstructed straight-line fluid flow.**
6. **All operating parts protected from damaging effects of service conditions and weather.**

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HOMESTEAD VALVE MFG. CO. • • • P. O. BOX 13, • • • CORAOPOLIS, PA.

Light — Strong — Compact — and Corrosion-Resistant CLEAR THROUGH,

that's PERMANITE!

An outstanding feature of Permanite is its adaptability to situations where size and weight are prime considerations. Above, for example, are two absorber towers and a fume washer of Permanite construction. Reinforced with woven fiber glass for added strength and supported with angle iron frames to facilitate handling, these units are lighter and more compact without sacrificing strength, corrosion resistance or operating capacity.

Permanite, a specially compounded furan resin structural material, is resistant to all alkalies, non-oxidizing acids, oil and most solvents, and will withstand thermal shocks and heat to 350°F.

Permanite is made by the manufacturer of Pyroflex and Knight-Ware—an organization with over 40 years' experience in the manufacture of corrosion-proof equipment.

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Acid and Alkali-proof Chemical Equipment

and vapors, resistant to sunlight and oxidation, and show a high tensile strength. Films formed from the vinyl polymers studied do not harden or dry by oxidation but are permanently thermoplastic and do not have the rigid structure over a wide temperature range exhibited by a varnish film. Pigmented latices produce harder films than those containing no pigment.

L. E. Ludwig, Montgomery Ward Paint Works, before a technical conference of the Chicago Section, American Chemical Society, and American Association for the Advancement of Science, Chicago, Dec. 26, 1947.

Tax-Supported Research, Pro and Con

TAX-SUPPORTED research has advantages and disadvantages. Since it is under no necessity to show a profit, it is possible to study certain types of problems of general national interest which no private concern would feel justified in undertaking.

This same absence of the profit motive, plus the permanence of employment and the proper interest of the personnel in any subject under study, makes it very difficult to terminate or redirect lines of research, even after they have lost any real promise of value.

Unless there is a definite mechanism set up and regularly used to keep government research in close contact with practical developments in a given field, work is likely to be undertaken or continued long after a given problem has ceased to be of importance. Research by governmental agencies is always subject to political pressure rather than being determined entirely by sound technical considerations.

In addition to the unfairness of the government's taxing business in order to compete with it, government research in fields of immediate industrial importance is likely to defeat its own ends by discouraging a much larger volume of research which would otherwise be undertaken by private industry. In the relatively few cases of discoveries by government laboratories which have possible industrial importance, it is usually difficult to bring about prompt commercial adoption because there is no pride of discovery to cause any one company to assume the heavy expense of development and marketing of a new product.

Government research is particularly well adapted to fields like agriculture and forestry, where the over-all public interest is large. Government research is also appropriate for making surveys of available raw ma-

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It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

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MEMO

TO: USERS OF HIGH PRESSURE COMPRESSORS

FROM: NORWALK COMPANY

Give Your Compressor a Drink of Water

Your high pressure compressor will last longer, give you better service, if you give its cooling system plenty of clean, cool water.

Make sure that water passages are clear, and kept clear at all times. Otherwise the compressor overheats. The same applies to compressors using coil and tank intercoolers—be sure that scale and rust deposits are removed periodically.

These are just common sense rules, but they will pay you in extra years of service from your high pressure compressor.

Reprints of these messages available for your maintenance men

Norwalk Compressors are custom-built . . . of standard, interchangeable parts. This combines the best of craftsmanship and modern methods, to give you a sturdy, reliable compressor, individually assembled and tested for your specific requirements.

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terial resources and methods of recovering same. The government is again the appropriate agency for much of the research in standardization and testing methods where it is important to have an impartial arbiter. Government agencies may also well undertake fundamental research into the basic reactions and characteristics of our raw materials, which is of value to industry generally, but which no individual company is likely to undertake on a broad scale.

R. E. Wilson, Standard Oil Co. (Indiana), before National Association of Manufacturers, New York, Dec. 5, 1947.

Sulphate Turpentine as a Chemical Raw Material

THE production of sulphate turpentine has been greatly increased during the past few years and, according to the reported production for 1945, was approximately equal to the production of wood turpentine or about one-half the production of gum turpentine. Thus, sulphate turpentine accounted for about 25 percent of the total production of turpentine in the United States. It would be more accurate to refer to the amount of sulphate turpentine recovered, for less than complete recovery of sulphate turpentine is achieved at many mills.

The trend to chemical uses is believed to be significant and to be indicative of the future trends in turpentine consumption. Turpentine offers a valuable raw material for chemical manufacture since it can be readily separated into hydrocarbons of high purity which possess a high reactivity and can be used as starting material for a variety of useful chemical products.

Large quantities of turpentine at stable and reasonable price will go far to insure the development of chemical markets. The outstanding growth of the wood rosin and turpentine production in the naval stores field has, in part, resulted from such a policy. The price of turpentine in recent years has lacked any apparent correlation to its value as a paint thinner or as a chemical raw material.

It appears that the ratio of alpha to beta pinene in a variety of samples of sulphate turpentine may vary considerably. This may be due to the kind of wood and it is possible that the conditions in making paper may affect the beta pinene content since this is the less stable of the pinenes. Apparently little is known of the composition of the monocyclic fraction, although presumably it is largely dipentene.

Alpha and beta pinene are reactive hydrocarbons that can be readily con-

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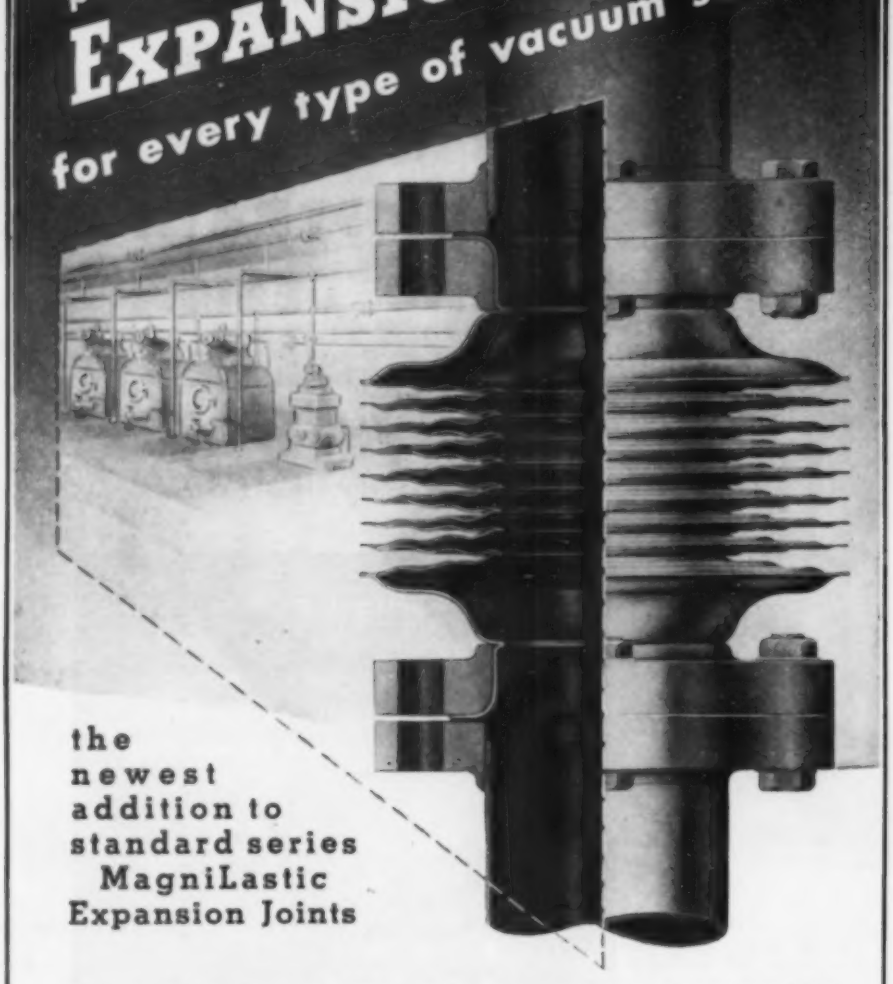
for every type of vacuum service



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Here is the first complete line of Expansion Joints designed and built specifically for vacuum service. Made in all pipe sizes from ½ to 24 inches. Tightness can be held to less than 1 micron per cu. ft. per hr. as determined by mass spectrometer tests. Operating temperature range is —100° to 500°F. Flanges are VanStone lap construction; corrosive media come in contact with stainless steel only. (Other materials and weld ends optional.)

The VacuLastic line culminates six years of MagniLastic engineering of all-welded metal bellows for vacuum systems in advanced industrial processes such as penicillin production and atomic research applications. Over 40,000 MagniLastic units are in constant trouble-free use. VacuLastic bellows are adaptable to packless valve construction and can be vibration dampened. For full information, please request Catalog 247.

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"There is a MagniLastic Expansion Joint for every piping need"

verted into a wide variety of materials. Among the changes that can be made on the pinenes are hydration to terpineol or the terpinyl ethers, isomerization to dipentene or camphene, polymerization to the dipolymer and to higher polymers, and addition of the pinenes to a wide variety of organic compounds. Many of these reactions are now carried out in large volume to produce a variety of commercial products including synthetic camphor, several types of commercial resins including alkyl and phenolic resins, special solvents, flotation agents, and insecticides. There are also many applications where terpenes can be satisfactorily employed but for numerous reasons are not extensively used today.

Sulphate turpentine on heating with dehydrogenation catalysts is converted into cymene in high yields. This hydrocarbon can be used as a starting material for dimethyl styrene, paramethylacetopheone, and for cumic acid. Dimethyl styrene does not polymerize readily but can be copolymerized with a variety of vinyl compounds to give synthetic resins and synthetic rubbers. Methyl acetophenone is a valuable perfume chemical, and cumic acid can be used for the preparation of plasticizers.

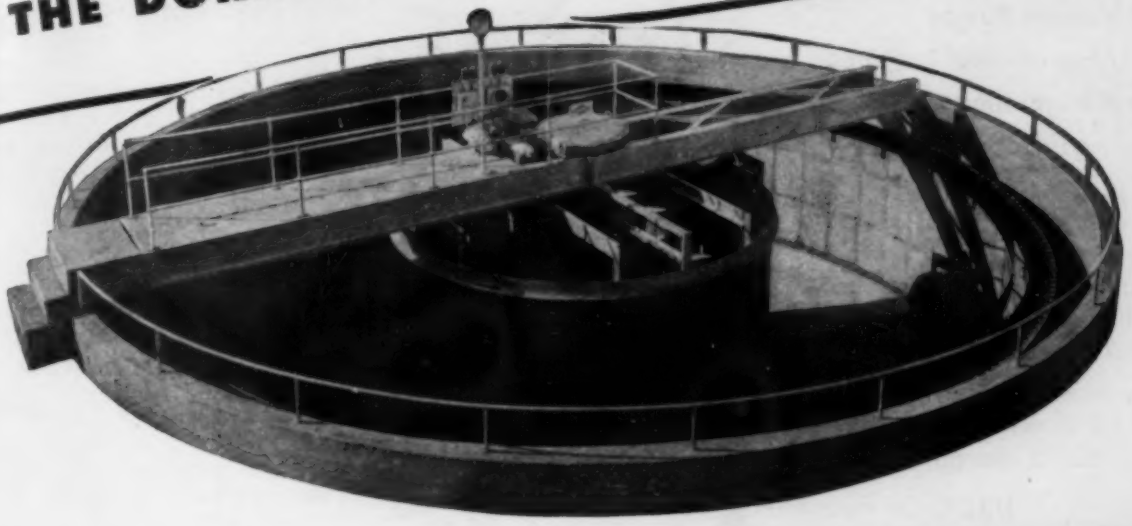
P. O. Powers, Battelle Memorial Institute, before Technical Association of the Pulp and Paper Industry, Asheville, N. C., Oct. 10, 1947.

High-Temperature Ceramics

PERHAPS the reason that so little work was done on high-temperature ceramic coatings is that there was no imperative demand for them. It was the scarcity of nickel and chromium and the fact that this scarcity might have become much more acute than it actually did, which led a number of people early in the war to think of using ceramic-coated mild steel in place of corrosion-resistant steel. The first efforts naturally were directed at the use of coatings already available, and as a matter of fact a considerable amount of the conventional type of porcelain enamel was used on exhaust stacks for aircraft engines.

There are two fundamentally different types of service in which high-temperature ceramic coatings are applicable. One of these is long-time service within a temperature range that may be arbitrarily stated as 1,200 deg. to 2,000 deg. F. The other is service for periods of a few seconds up to say, five or ten minutes, where temperatures may be on the order of 3,500 deg. F. and up. Within limits, and subject to much further improvement, either of these conditions can be met at the present time. But

THE DORRCO CLARIFLOCCULATOR



IN *the Processing Picture for* { WATER PURIFICATION / BRINE PURIFICATION / WASTE TREATMENT

WHEREVER Flocculation and Sedimentation are required as a step in the processing picture, the Dorrco Clariflocculator is worth careful consideration. A two-in-one unit, it provides mechanical flocculation with or without chemicals in a central compartment, and sedimentation of the flocculated solids and clarification of the solution in an annular, mechanically cleaned outer zone.

FOR WATER PURIFICATION it will remove turbidity, color or hardness to give you a specification water to fit your most exacting process requirements.

FOR BRINE PURIFICATION it will deliver an effluent suitable for rapid sand filtration by reducing turbidity and removing both soluble and insoluble impurities.

FOR WASTE TREATMENT it will handle your disposal problem by removing suspended solids — and in some cases may even effect a recovery of valuable constituents for reuse.

Why the Dorrco Clariflocculator over other types of flocculation and sedimentation equipment? First, because of maximum utilization of tank volume—due to central subsurface feeding, peripheral collection of overflow and controlled agitation during floc formation. Second, because Dorrco Clariflocculator installed and operating costs are less than for any other combination of separate units producing the same results.

● *Why not let a Dorr engineer study your problem with you and give you the benefit of our experience on Clariflocculator performance in the Process Industries?*

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- For Absolute Low Pressures
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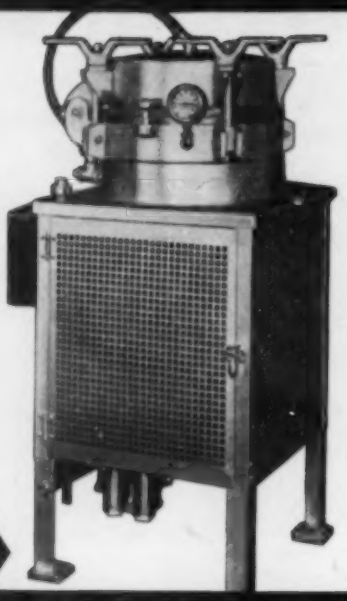
Save Money — Oil — Equipment

Complete HILCO Vacuum Pump Lube and Sealing Oil. Continuous Purifying System Plans Available

Let us show you how to deliver pure oil to refrigeration units with a HILCO charging system.



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AT C. R. R. OF N. J.
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DEPENDABILITY

the combination of the two—the longer period time and the higher temperature range—is a dream for future fulfillment.

The compositions of high-temperature ceramic coatings may be briefly summarized. The first such coatings for low carbon steels were composed of admixtures of powdered refractory ingredients with conventional types of porcelain enamel frits. NBS ceramic coating A-19 was composed of 50 parts of a relatively "soft" or fusible frit, 50 parts of a relatively "hard" or infusible frit, 25 parts of calcined alumina, 10 parts of enamelers clay, and other minor ingredients.

Varying the ratio of frit and refractory ingredient varies the several properties of the mixture, and ratios all the way from 5/95 to 95/5 have been used as coatings. For that matter, it is possible under some conditions to apply a coating of practically pure refractory material to metal and on a limited scale this has been done. Conventional enamels contain no refractory mill additions of the type under discussion.

Although military necessity has mothered most of the development work which has been done on high-temperature ceramic coatings for alloys, their possibilities for industrial uses are increasingly coming to the fore.

W. N. Harrison, National Bureau of Standards, before symposium on Modern Metal Protection, Cleveland, Sept. 27, 1947.

Chemicals for Paper in 1948

IN GENERAL, the outlook for the paper and paperboard industries for the next several years has been predicted excellent by many students of business activities. However, the chemical outlook appears rather gloomy.

In spite of the fact that the war has been over a considerable period of time, the paper industries as well as other consumers have not found caustic soda any freer. In some cases, suppliers have been unable to furnish the maximum amounts requested by paper manufacturers. This condition of tight supply will continue despite some increased production. There will be some added productive facilities coming in the South and Southwest, and this should improve conditions in that area. We should expect the tight situation to continue for at least another year.

Lime prices increased in 1947 due to the extremely high jump in the cost of fuel, increases in other raw materials used in the manufacture of lime, and wage increases. The lime market, in general, has been very tight,

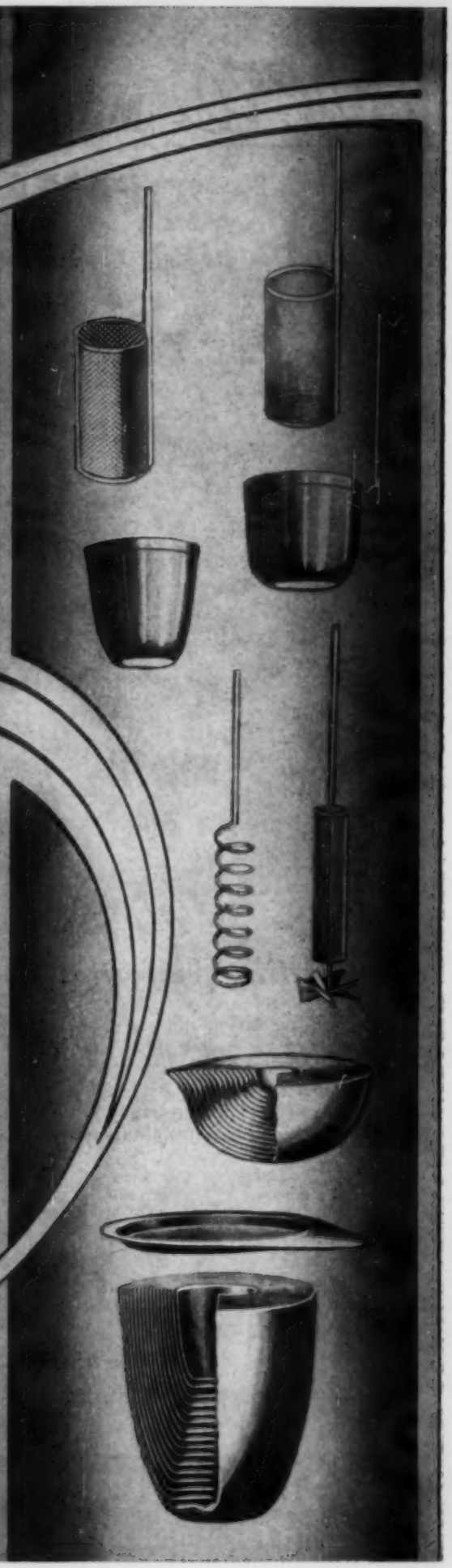
BAKER Platinum Laboratory Ware

Tested by Use

We have been manufacturing platinum laboratory ware for almost three quarters of a century and during that period have done much to bring this ware to its present exactness and high state of development. We introduced such design changes as our reinforced rim crucibles and dishes, the Baker Low Form Crucible and our platinum-rhodium alloy, laboratory ware made of which, is so highly regarded.

Because, naturally, our large scientific laboratories use apparatus manufactured by us in their own work, Baker Laboratory Ware is constantly subjected to continuous tests through use and so we are enabled to detect the need for improvements. An example was our observation of the tendency of stationary type electrodes to break at the junction of stem and cylinder, a fault which we overcame by reinforcing this joint.

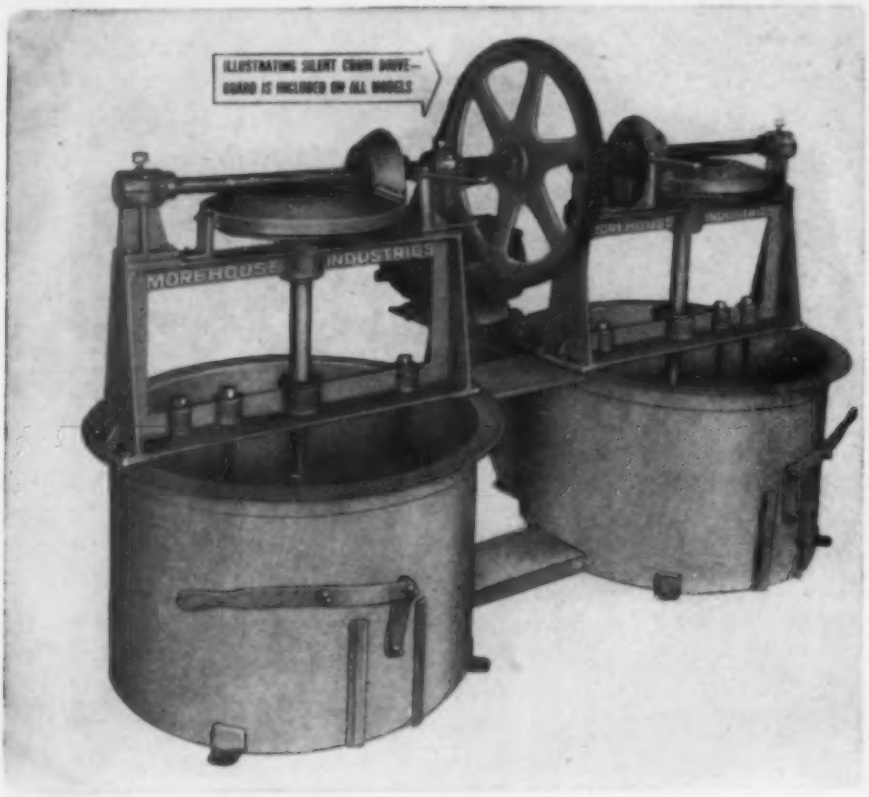
Let us send you a copy of *Data Concerning Platinum*. It tells about our products and is a very valuable reference work too.



BAKER & CO., INC.
113 Astor St., Newark 5, N. J.
NEW YORK SAN FRANCISCO CHICAGO

New MOREHOUSE TWIN PASTE MIXER . . .

now available for immediate shipment



Outstanding performance proven in use:

Here is the mixing unit you've been looking for to step up production. Any one of the three sizes available will give you dependable, efficient production at high speed. One user of our Model 15 reports twin batches of 150 gallons (300 gallons in all) mixed in 10 minutes! All are ready for immediate shipment now, ready for quick and easy installation in your plant.

3 Sizes

Model Number	Gallons Per Tub	Height of Tubs	ID of Tubs	Motor Size
11	110	20.5"	42"	7½ H.P.
15	150	27.0"	42"	10 H.P.
22	225	39.5"	42"	15 H.P.

Optional drives: **All models can be supplied with Silent Chain or V-Belt Drives as desired, and with or without motors and full electrical equipment.**

Write today for complete details

Mfd. by the makers of the famous Moorehouse HY-R-Speed Mill

MOREHOUSE INDUSTRIES
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and it is the opinion of producers that this condition will continue during 1948.

The market for soda ash, although currently tight, is expected to become normal for 1948 as new production enters the field. The excellent quality of soda ash has been well maintained under adverse operating conditions, and it is expected will continue throughout 1948.

The salt cake situation has not improved. Unless new sources of salt cake are found for 1948, the paper industry is going to be in a rather bad way.

Chlorine available for all industry has shown some increase during 1947 and will show further increase during 1948. Indications are that production will come into balance with consumption during 1948.

Sodium peroxide demand is expected to continue to exceed the supply in 1948. From a technical point of view hydrogen peroxide and sodium perborate are interchangeable with sodium peroxide for pulp bleaching. Economic considerations govern the choice of a peroxygen compound for this use.

Notwithstanding continued high demand, consumers can be assured of an adequate supply of sulphur to meet their full requirements.

Sulphur dioxide should be available during 1948, although in some areas tank car equipment may delay prompt shipments.

Acrylic and alkyd resins became readily available during 1947 and prompt shipment was made against purchase orders is received. It does not appear likely that the acrylic resins will become scarce in 1948.

The glycerin supply situation is seen as being considerably improved over last year and at the present time the producers are generally making prompt deliveries to both old and new customers.

E. N. Poor, American Cyanamid Co., before Technical Association of the Pulp & Paper Industry, New York, Feb. 23, 1948.

Streptomycin and Tuberculosis

WITHOUT doubt the greatest good, to the greatest number will come from streptomycin utilized in treatment of the great "white plague," tuberculosis. The statement can be defended that even in this enlightened age tuberculosis is the most important infectious disease of mankind.

Degenerative diseases of middle and later life are often considered the greatest. Cancer and heart disease kill the most people. But these are dis-

NOW 66

15 more since we first published this advertisement in October, 1946

~~51~~

100,000 to 10,000,000 CU. FT.

ALL-WELDED GAS HOLDERS

Largest all-welded, wet seal gas holder in the United States—5,000,000 cu. ft. capacity. Installed by Stacey Brothers Gas Construction Company at Long Beach, California.

Who built the largest all-welded, panel type gas holder in your vicinity?

Chances are, the answer is *Stacey Brothers Gas Construction Company.*

We say "chances are", because we've built *more than* ~~60,000,000~~ 77 *cubic feet of holder capacity.* The largest of these installations—100,000 to 10,000,000 cubic feet—are shown on the map. Note, particularly how many of them have been repeat orders. In addition to these big ones, we've designed and constructed many, many smaller ones—even down to 100 cubic feet.

You have only to make a personal inspection trip to any one of these installations and you'll know why Stacey Brothers has been the choice of so many operators. You'll see a holder that's not only good to look at—it's even better to operate! A mechanically round structure, free of unsightly deformations, is one clue to trouble-free, dependable, *economical* operation.

Since we first introduced the famous patented all-welded, panel type construction in this country we've had more experience in building all-welded holders than any other company. You can capitalize on that experience.

May we arrange an inspection trip for you?

STACEY BROTHERS GAS CONSTRUCTION CO.

One of the Dresser Industries

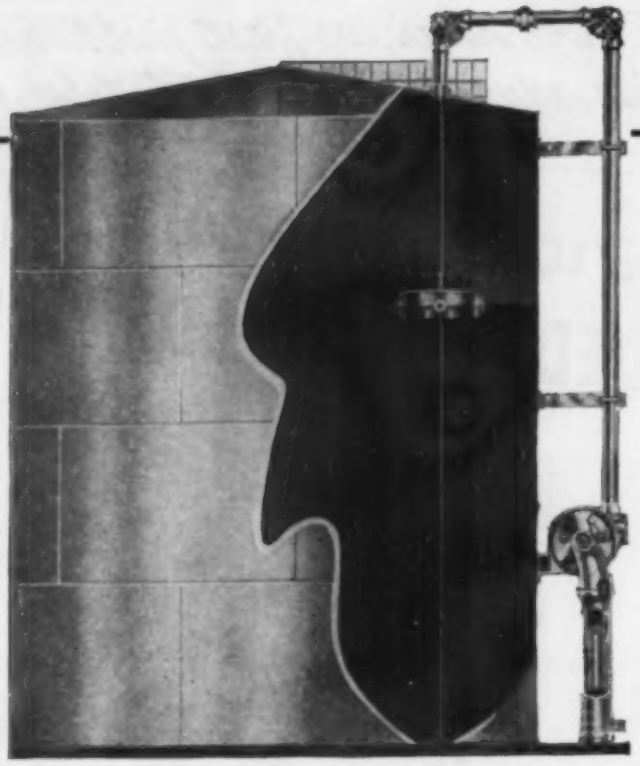
5535 VINE STREET • CINCINNATI 16, OHIO

Now installing 10,000,000 cu. ft. holder at Elizabeth N. J.

Largest all-welded, dry seal gas holder in the United States—10,000,000 cu. ft. capacity. Installed by Stacey Brothers Gas Construction Co., at Dearborn, Michigan.

Stacey Brothers

ALL WELDED GAS HOLDERS



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For Accurate Gauging of Corrosive or Toxic Gases Under Pressure

"VAREC" Gastight Automatic Tank Gauges offer you the best means of accurately determining quantities of corrosive or toxic liquids without danger to equipment or personnel. They may be installed on new tanks or tanks already in service. Readings are taken at eye level on the ground.

The Figure No. 253 Gauge illustrated above can be installed on all types of gastight tanks with fixed roof operating under pressures up to 30 p.s.i. Other "VAREC" Approved gauges are manufactured for a variety of special requirements. High and low level alarm mechanisms are available for installation with these gauges. Also, a simple hand tester may be attached for ascertaining that the tape is taut and the float and sheaves are free at all times.

"VAREC" Approved Tank Gauges are all described in detail in the "VAREC" P-7 Handbook and Catalog. We invite your inquiries on special gauging problems.

CP-4

"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, USA

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cases of older people, while tuberculosis is a disease which is most destructive during the early years of adult life. Dr. Mary Dempsey points out that the average white woman may expect to live for 60 years. If she dies at the age of 24 from tuberculosis, instead of dying at 69 she has lost 45 potential years of life. On the other hand, if she should die at the age of 62 from cancer, she has lost but 7 potential years of life. In the aggregate, approximately 1,300,000 potential years are lost by those who die of cancer. Those who die of tuberculosis also have lost approximately 1,200,000 years of potential life.

Just what can streptomycin do in the fight against tuberculosis? This is the first drug to be made available which has real usefulness in this the most important infectious disease affecting the human race. But there are many kinds of tuberculosis; many different diseases produced by tubercubacilli and each offers special problems.

Until the advent of streptomycin, thousands of people died each year from miliary tuberculosis and tuberculous meningitis. Streptomycin is the only effective remedy. While it has not cured all, it is a very great remedy by offering the first real hope in the treatment of a disease which was formerly almost universally fatal.

Another dreaded and painful type of tuberculosis involves the larnyx and the vocal cords and a somewhat similar type may produce ulcers in the windpipe and larger bronchial tubes. This type which was so resistant to other forms of treatment, has responded to streptomycin in a very high percentage of cases and in a very prompt manner.

Some types of tuberculosis of the intestines, a miserable form of the disease, have been alleviated by streptomycin treatment in a very gratifying manner. Tuberculosis of bones and joints which cripples so many children is only now being studied and no one knows what the final answer will be. But there is reason to hope that streptomycin alone or in combination with surgery may be of considerable help in some of the most baffling problems in this field.

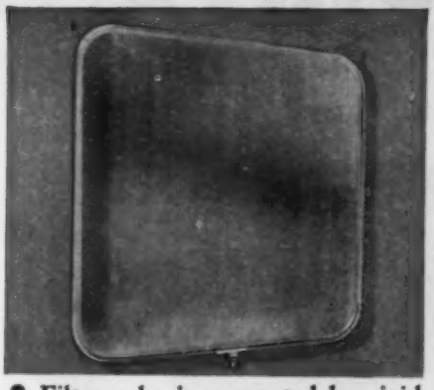
Tuberculosis of the lungs accounts for more than 90 percent of all deaths from this disease. Tuberculosis of the lungs is a destructive type of disease, and lung tissues which has been destroyed cannot be regenerated. However, there is no longer any doubt but that streptomycin has very great value in some of the most fulminating types of lung tuberculosis.

Research on streptomycin in tuber-

NIAGARA PRESSURE-LEAF FILTERS

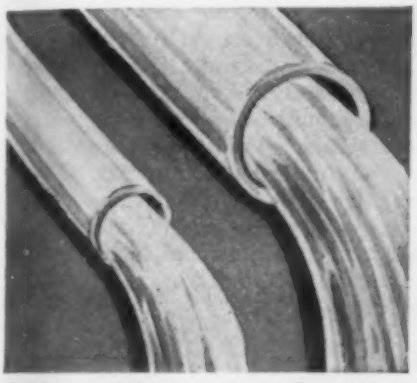
Give you all these advantages!

• You get a completely closed system . . . safe for handling toxic, flammable, and explosive liquors . . . leak-proof and contamination-proof.

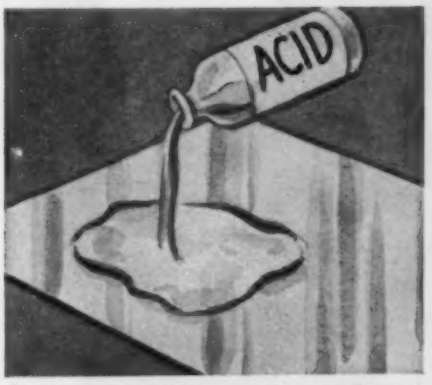


• Filter cake is supported by rigid stainless-steel leaves that never wear out with proper care . . . withstand high temperatures and pressures.

• You eliminate saggy filter cloths which cut down filtration rates and which must usually be washed after every cycle and replaced frequently.



• You get from two to five times greater flow rates per unit filter area than are possible with old-style filter presses. You get longer filtration cycles and less down-time.



• You get 100% corrosion resistant construction . . . stainless steels or any other metal required for your particular application. This reduces maintenance costs, such as painting.

• In high-quality stainless-steel construction, Niagara pressure-leaf filters are up to 40% lower in cost than filter-presses with equivalent filter area and material of construction.

PARTIAL LIST OF CHEMICAL PRODUCTS SUCCESSFULLY HANDLED WITH NIAGARA PRESSURE-LEAF FILTERS . . . .

Aluminum acetate	Phenolic resins
Cellulose acetate resins	Phenolphthalein solution
Fish-oil concentrate	Potassium chlorate
Formaldehyde	Saturated boric acid
Fumaric acid	Sodium sulphide
Liquid soap	Succinic acid
Manganese acetate	Sulphite liquor
Molten sulphur	Zinc chloride solution

We can provide authentic case histories on all of these products to explain in detail how they are being filtered with Niagara pressure-leaf filters. Our engineering and research staff will be glad to study any specific filtration problem you care to submit. Write to Department CE-3 for details on this service . . . and for a copy of our general bulletin G-447.

niagara filter CORP.

BUFFALO 14, N. Y.

FILTRATION ENGINEERS TO THE CHEMICAL INDUSTRY

IN CANADA . . . . NIAGARA FILTER CORPORATION (CANADA) LTD.

Represented by Experienced Filtration Engineers in New York, Philadelphia, Boston, Detroit, Chicago, St. Louis, Cincinnati, Milwaukee, San Francisco, Toronto, Winnipeg, Mexico City and Principal Cities of the World.

culosis is continuing at an ever accelerating pace for much remains to be learned. Large amounts of money, actually millions of dollars during the present year, are being expended in learning how to use streptomycin effectively. That streptomycin is useful, is known, that it may be harmful when misused, is known; that it may fail when it should succeed, has been learned with regret.

But the fact remains that streptomycin is the first drug to be made available and to be effectively used against tuberculosis in man.

H. C. Hinshaw, Mayo Clinic, before Eighth Chemical Engineering Award dinner, New York, Dec. 3, 1947.

High Pressure Research Work

APPLICATION of high pressure in the process industries has increased rapidly in recent years. Among the high pressure processes may be mentioned the synthesis of ammonia from nitrogen and hydrogen, methanol from carbon monoxide and hydrogen, and the hydrogenation of coal as developed in Germany for motor fuels—processes which would not be commercially feasible without recourse to pressures of several hundred atmospheres. More recently superhigh pressures have been applied to polymerization and alkylation reactions and high pressure research is continuing in the petroleum industry.

High pressure speeds up reaction rates by increasing the concentration of the reacting materials. In reactions proceeding with a decrease in volume, pressure elevation increases the equilibrium yields or conversions. In some instances the path of a reaction can be changed by pressure increase even when the reactants, catalyst, and the temperature are the same. At atmospheric pressure the main reaction with hydrogen and carbon dioxide over copper-alumina catalyst is the formation of carbon monoxide and water with no appreciable yield of methanol; at 6,000 psi. methanol conversions in excess of 90 percent can be obtained. In view of the growing industrial importance of high pressure operation the flow apparatus described was constructed for high pressure research work on a laboratory scale.

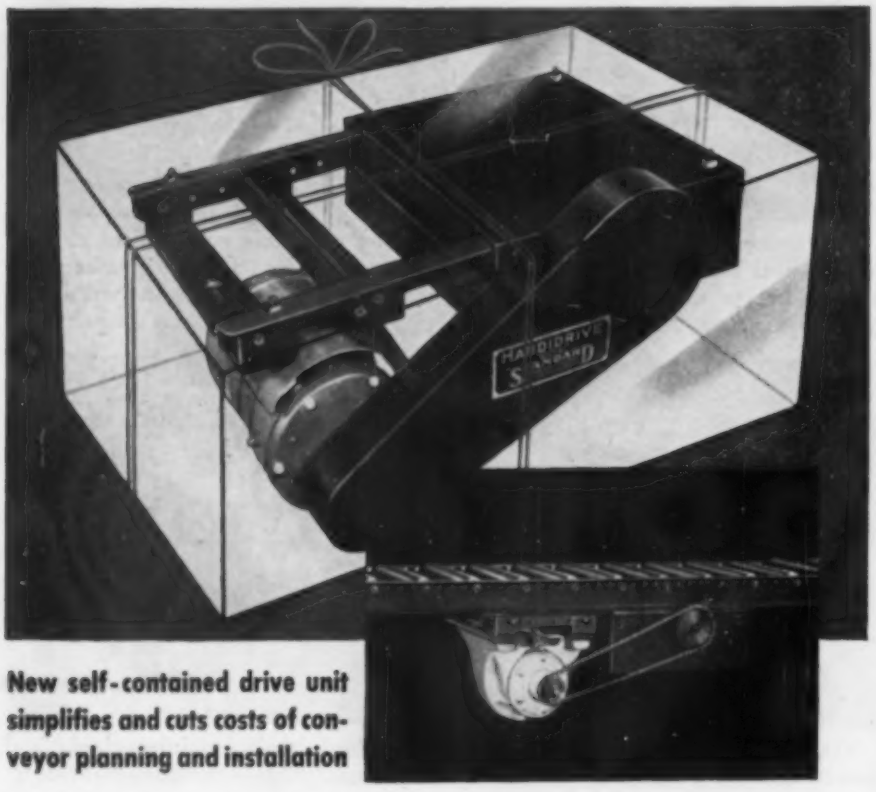
The high pressure flow plant was designed to process, thermally or catalytically, normally liquid or gaseous material, or combinations of both, at pressures up to 13,000 psi. and at temperatures up to 565 deg. C.

That part of the equipment withstanding pressure is enclosed within iron barricades. Peep holes, covered with bulletproof glass, permit the observation of instrument readings, and

Announcing the new Standard

HANDI-DRIVE

. . a "power package" unit for all types of roller and belt conveyors



New self-contained drive unit simplifies and cuts costs of conveyor planning and installation

Here it is! A packaged power unit that gives every conveyor user the opportunity to be his own layout engineer — to change his conveyor system to suit varying plant conditions in a minimum of time!

Converts gravity conveyors to live belt or roller conveyor quickly . . at low cost

The Handi-Drive is a self-contained drive unit for applying tractive power to gravity conveyor belt or rollers. Equally important, using standard units you can build a conveyor system custom-planned to your individual plant needs. Standard units are stocked at the factory — you can get them now!

If you want to convert your present gravity conveyors to powered units — or if you want to install your own new system . . . send for the Handi-Drive Bulletin No.CM-38.It gives you complete design information and prices — tells you how to lay out your system, gives complete data on inclines, belt and roller widths, curves, weights to be handled and types of packaging or units to be moved. Write: Standard Conveyor Company, North St. Paul, Minnesota.

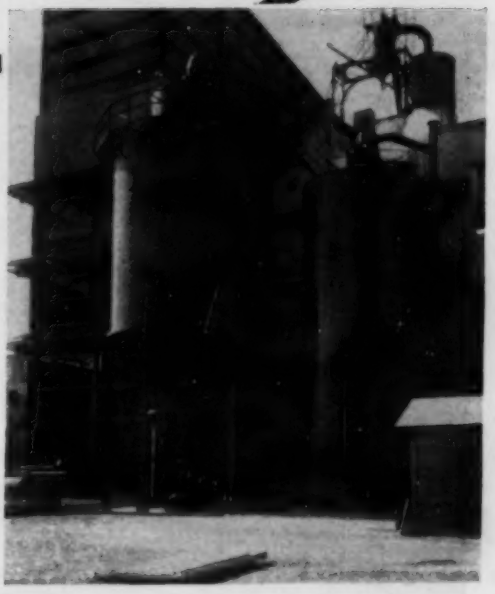
SEND FOR HANDI-DRIVE BULLETIN

Standard
GRAVITY & POWER
CONVEYORS

PAPER MILL EXPANSION INCLUDES *More* HORTON STEEL PLATE STRUCTURES

REPEAT orders are a good indication of a satisfied customer. Over a period of years, we have furnished the Florida Pulp & Paper Company mill at Cantonment, Florida with many steel plate structures. A few of the more recent ones are shown on this page. All of this equipment was designed, fabricated and erected to meet specific requirements.

Our facilities for designing and building all kinds of steel plate structures for chemical and process plants are complete in every detail. We build vessels according to code requirements or your own specifications—stress-relieving and x-raying when required. We can also furnish special linings in new or existing structures if the products you are handling are of a corrosive nature. When figuring on process equipment that requires steel plate work—write our nearest office for quotations on Horton steel plate structures.



Right: A 22-ft. diam. by 25-ft. blow tank and a 15-ft. diam. ***by 40-ft. foam tank.***

This welded steel storage tank is 20 ft. in diam. by 18 ft. high. It is used to store liquids and has a capacity of 42,000 gals.

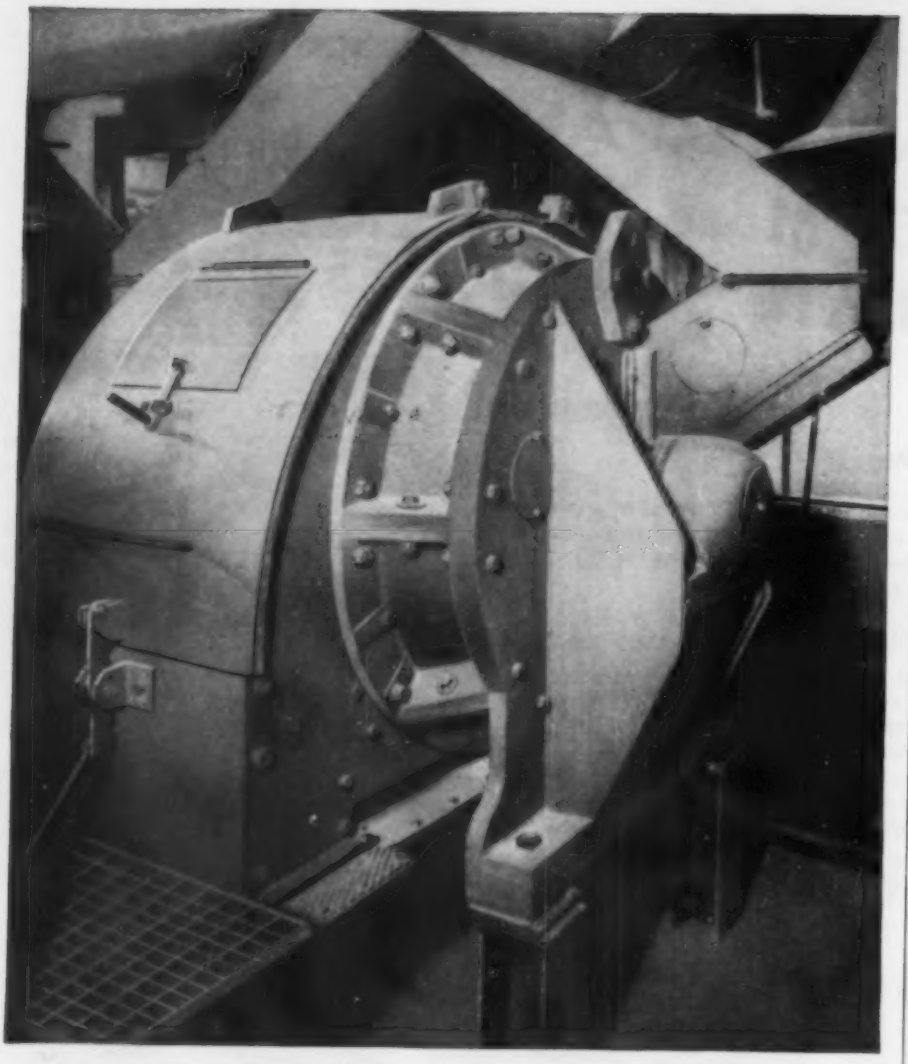
This photo shows part of one of the three 9-ft. diam. by 40-ft. 9⅞-in. digesters we recently built for this mill.

The liquor tank shown above is 25 ft. in diam. by 25 ft. high. It was designed and built for paper mill service.

CHICAGO BRIDGE & IRON COMPANY

Los Angeles 14.....1405 Wm. Fox Bldg.	Cleveland 15.....2220 Guildhall Bldg.	Birmingham 1.....1510 North Fiftieth St.
San Francisco 11....1222-22 Battery Street Bldg.	Detroit 26.....1503 Lafayette Bldg.	Atlanta 3.....2120 Healey Bldg.
Chicago 4.....2124 McCormick Bldg.	Philadelphia 3....1625-1700 Walnut Street Bldg.	Havana .....402 Abreu Bldg.
New York 6.....3318-165 Broadway Bldg.	Tulsa 3 .....1623 Hunt Bldg.	Houston 2.....2103 National Standard Bldg.

Plants in BIRMINGHAM, CHICAGO, and GREENVILLE, PA. *In Canada*—HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.



Uniformity

IN THE REDUCTION PROCESS

If your process depends upon the efficiency of your reduction operation, you will find it helpful to check the advantages offered by the Prater Dual-Screen Pulverizer. Oversize screens covering more than 70 percent of the area of the final sizing drum give you a granulation that is always the same . . . always uniform in its high quality.

In addition, Prater equipment offers you triple reduction grinding and side feeding from one or both sides. Low starting load and low power costs are the result of 1,800 r.p.m. operation which permits direct connection to standard electric motors.

For details on Prater Pulverizers for your process, write today. The Prater Pulverizer Company, 1517 South 55th Court, Chicago 50, Illinois.

PRATER PULVERIZERS

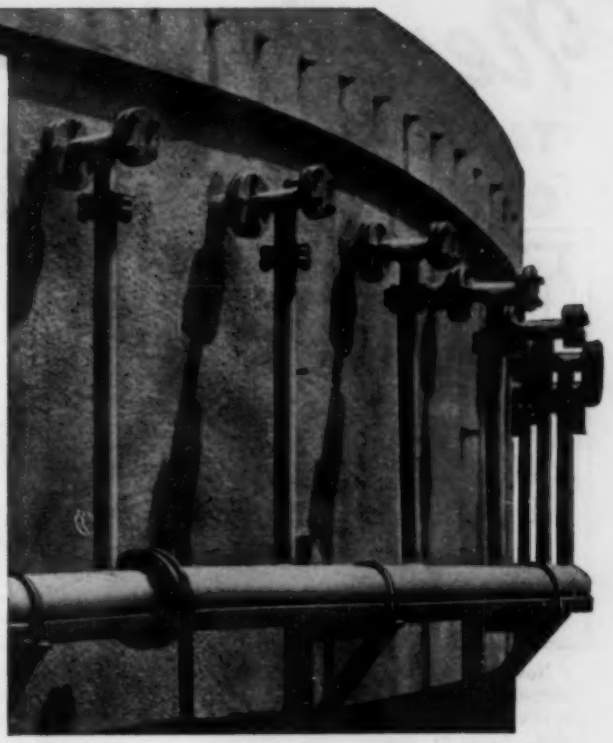
all high pressure control valves extend through the barricade walls in order that the operation may proceed with due protection.

The apparatus consists essentially of six parts: (1) A high pressure gas charging system having six high pressure cylinders—three (3,600 ml. each) for pressures up to 6,000 psi. and three (1,400 ml. each) for pressures between 6,000 and 13,000 psi., the top outlets of all six being manifolded to the gas feed line which leads to the inlet end of the reaction tube, and the bottom outlets to the discharge side of a motorized, variable stroke hydraulic pump, the intake of which is manifolded to six water graduates; (2) a gas mixing pump connecting the upper and lower manifolds of the low pressure cylinders, for making up composite gas charges; (3) a liquid charging system consisting of two heavy duty calibrated liquid chargers for liquids of high vapor pressure, and two calibrated glass cylinders for liquids of low vapor pressures, one of each type being manifolded to the suction ends of a two-unit variable stroke liquid feed pump which discharges into the preheater section of the reaction tube; (4) a copper-lined high pressure reaction tube (catalyst capacity, 50 ml.) supported in an electrically heated stainless steel block furnace with an automatic temperature regulator; (5) a pressure controller attached to the exit end of the reaction tube, releasing the products to atmospheric pressure before condensation; and (6) a cold water condenser and receiver, or gas separator. The gas from the receiver is led consecutively through a wet ice and dry ice-acetone trap to a wet test meter.

Operation of the apparatus is relatively simple. By alternately charging the process gas into one of the gas charging cylinders at the available supply pressure of the storage and forcing the gas into another cylinder by water displacement by means of the hydraulic pump, the gas pressure may be raised to the desired operating level. The quantity and the density of the pressured gas may be calculated from P-V-T data.

During the pressure experiments the compressed gas is discharged at the operating pressure level from the supply cylinder by water displacement into the preheater section of the reaction tube. From the amount of water pumped the amount and flow rate of the gas are easily determined.

Liquid materials are charged by the liquid feed pump. In the preheater section of the reaction tube, which contains copper punchings or other inert material, the vapors of the liquid charge mix with the gaseous charge and pass downward through the cata-



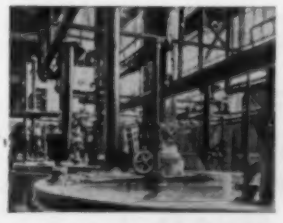
Go Lead for Acid Piping

When installing acid pipe lines for long, trouble-free service, go for a material that stays on the job. *Go National for Lead!*

Lead has proved itself the accepted corrosion-resisting material for acid conveying. National Lead gives you all of lead's advantages, engineered into acid pipe and fittings that withstand elevated or fluctuating temperatures, pressure, vacuum and vibration.

Here are three types ready to help you fight acid corrosion and mechanical stress:

1 All-Lead Pipe: National's Chemical Lead Pipe is widely used throughout industry. Of practically pure lead, substantially free of bismuth, it contains a small amount of copper, which boosts corrosion resistance and endurance limit. The extrusion process used in fabricating this pipe assures uniform wall thickness, free flow, and freedom from porous or defective spots.



***All industry** knows the dependability of lead for acid handling. Here are Chemical Lead Pipe and Fittings used with a battery of digestors.*

This is our *regular* lead pipe. It has become "standard" in many industries. Other useful types are made by alloying small amounts of other metals with chemical lead.

For example, our Tellurium Lead Pipe gives you *extra* corrosion resistance at high temperatures . . . *greater* tensile strength and toughness . . . *higher* endurance to vibratory stress.

Or, if you need *extra* resistance to erosion, there's also our Antimonial Lead Pipe. This is made with a base of either Chemical or Tellurium Lead. By adding 6% of antimony, tensile strength is almost doubled and hardness and stiffness are greatly increased.

2 Cold Expanded Lead-Lined Pipe: Here's lead pipe plus the strength of iron or steel. It's our "United" Lead-lined Cast Iron or Steel Pipe. *Outside* you have all the strength needed to stand pressure or other mechanical stress; *inside*, the ability to resist corrosion.

***Lead's corrosion resistance** plus the strength of steel! "United" Lead-lined Pipe brings you both.*

The lead lining is formed in continuous lengths of seamless pipe, then cold-expanded against the inside of the iron or steel tube. You get a tight fit and a smooth, uniform lining, free of defects. All iron and steel pipe used meets ASTM standards.

3 "United Tubond" Lead-Lined Pipe: For handling corrosive liquids or gases at extremes of temperature, pressure, vacuum or vibration, we recommend our "United Tubond" Lead-lined Pipe. This is steel or wrought iron pipe with its lead lining permanently *bonded* to the ferrous metal. No separation or creep is possible. The toughness of the bond is demonstrated by the illustration below.

All our lead-lined pipe is available in flanged sections, with the lead lining carried over the face of the recessed flange. This insures a positive lead-to-lead seal at each flange, eliminating any leakage at joints.

***Bonded for keeps!** Once bonded . . . "Tubond" Lead-lined Pipe stays bonded. Even severe twisting can't break the bond.*

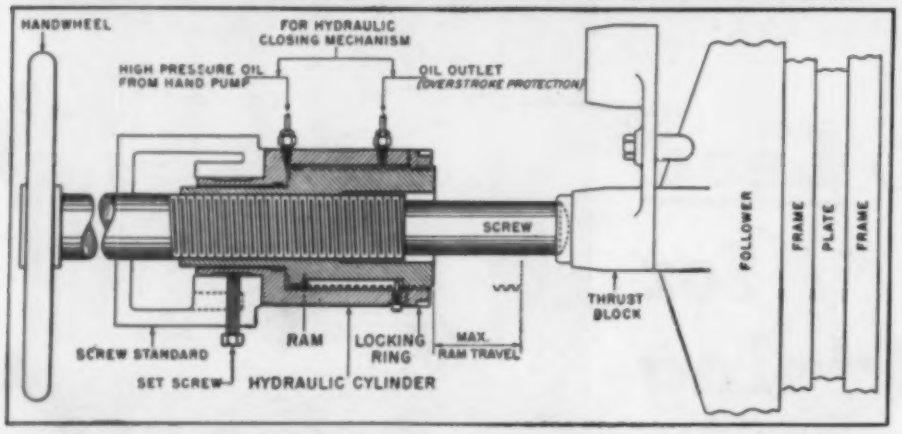
Go National for Lead

. . . pipe . . . valves . . . sheet . . . lead-lined or lead-covered equipment . . . even complete acid recovery plants. Behind every National Lead recommendation, every National Lead product, are years of experience and many important installations in every field handling corrosive liquids and gases.

NATIONAL LEAD COMPANY
111 BROADWAY, NEW YORK 6, N. Y.
Offices and Plants in Principal Cities and Canada

New! HYDRO-KLOSER

TAKES BACK BREAKING LABOR OUT OF FILTER PRESS OPERATION



Now you can equip your 24" and larger Shriver Filter Presses with a really simple hydraulic closing device that's inexpensive, easy to install and operate. It eliminates the hard labor and safety hazards of manual closing, and reduces opening and closing time considerably.

This compact, self-contained, fool-proof Shriver Hydro-Kloser replaces the thrust obtained by manual movement of the screw with the straight thrust of the hydraulic ram. A few easy strokes of the hand pump close the filter press tight, and a locking nut keeps it tight. To open the press, the locking nut is released and the hydraulic pressure is then released by opening the pump.

The "Hydro-Kloser" is a real aid to filter press operating economy and convenience. Write for Bulletin 125.

T. SHRIVER & COMPANY, Inc., 802 Hamilton St., Harrison, N. J.

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Patented "GEMCO" CONICAL BLENDER

BLENDS PERFECTLY
In Batches
UP TO 25,000 POUNDS
WITH UNIFORM RESULTS

¼ H.P. • • • 40 H.P.
Built as a Unit

FINGER-TIP CONTROL
Stops in Desired Position.
Charging and Discharging controlled by one operator working from the floor.

NO SPILLING • NO DUSTING
Absolutely Trouble-Free

The blending machine that's ready for immediate operation (as a complete unit) without elaborate concrete construction or further engineering.

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GENERAL MACHINE COMPANY OF NEW JERSEY

Established 1916
SPECIAL CHEMICAL and MIXING MACHINERY
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lyst zone, and the products pass out through the pressure release valve on the exit end of the reaction tube to the condenser where the liquid product separates. The gas passes on through the traps to remove any normally liquid product entrained in the gas stream and thence to the wet test meter.

This apparatus has been used for the study of various reactions under high pressures, such as the synthesis of methanol from carbon dioxide and hydrogen at 6,000 psi., the conversion of benzene and benzene-methane into toluene at 13,000 psi., and for the evaluation of other high pressure processes.

V. N. Ipatieff, G. S. Monroe and L. E. Fischer, National Oil Products Co., before Petroleum Division, American Chemical Society, New York, Sept. 17, 1947.

Moving Natural Gas by Centrifugal Compressors

For many years the gas transmission industry has recognized only one method of pumping: the use of gas engine-driven reciprocating compressors. This idea prevailed because electric power costs seemed excessive and because when comparisons were made between the two types of prime movers (gas engine and electric motor) both using reciprocating compressors, the spread in investment between the two types was not sufficient to warrant further consideration.

Today the centrifugal pump is being installed by the oil industry on pipelines almost exclusively, for three principal reasons: (1) much lower investment, (2) less maintenance, (3) less operating labor.

Now that the centrifugal gas compressor is developed to such an extent as to permit its use for discharge pressures of the order of 500 to 800 psi., an attractive opportunity for its use in gas transmission has appeared in connection with the two transcontinental pipelines built by the government. The manner in which the lines were constructed contained all the elements for making use of motor-driven centrifugal compressors a possibility. The lines are installing 15,000 h.p. in two stations now, and expect to add about 60,000 h.p. more next year, and the Tennessee Gas Transmission people have obtained permission to install a 6,000 h.p. intermediate booster station in Kentucky.

Centrifugal compressors are ideally suited for use to increase the capacity of an existing pipeline instead of following the conventional method of laying parallel pipes or loops. In general, if the original capacity is to be increased 25 percent, it becomes necessary to lay a loop of the same diameter

TO PUT YOUR BUILDING UP *fast*

A building of structural steel with Plastipitch Protected Metal roof and sidewalls can be erected more rapidly than one of masonry or brick

TO PUT IT UP *economically*

A building of Koppers Plastipitch is basically more economical, and prices have not risen in the same proportion as many other building materials

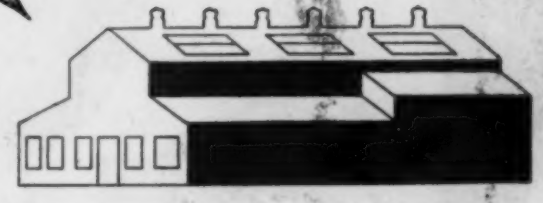
USE KOPPERS PLASTIPITCH* PROTECTED METAL

TO KEEP IT *flexible* **FOR PROCESS CHANGES**

A building erected with Plastipitch can be altered, enlarged, or taken down and moved to a new location, if processes change

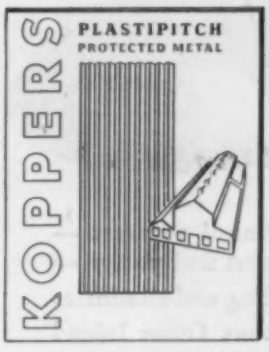
TO PUT IT UP *permanently*

With the Koppers Plastipitch method of protecting steel sheets, they are safeguarded from weather, salt-air, corrosive industrial atmospheres, etc.



Plastipitch Protected Metal is backed by six years of industrial applications, and by thirty years of Koppers experience in the manufacture of coal tar pitch for roofing industrial buildings. Send for this manual which tells recommended uses, methods of erection, and the help you can get from Koppers on detailing special shapes, gutters, downspouts, flashings and other accessories for a Plastipitch building.

*Reg. Trade Mark, U.S. Pat. Off.



KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

Please send me free copy of your manual on Plastipitch Protected Metal.

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KOPPERS SUPPLIES MORE KINDS OF WATER-REPELLENT, CORROSION-RESISTANT COATINGS FOR MORE PURPOSES THAN ANY OTHER COMPANY

(1) Coal-tar pitch roofing (2) Bitumastic Protective Coatings for pipe, structural steel and other metal, concrete, masonry and insulation. (3) Plastipitch Protected Metal for roofing and siding of industrial and farm buildings (4) Coal-tar waterproofing and dampproofing.

★ A clean interior for food and chemical products — cover sealed air tight preserves freshness and purity — sturdy construction resists rough handling and eliminates losses through leakage or contamination. Other Inland Steel containers range from 3-gallon to 55-gallon capacities with a wide variety of spout openings and cover styles suitable to any liquid or semi-solid products.

INLAND STEEL CONTAINER CO.

Container Specialists

4532 S. MENARD AVENUE, CHICAGO 38, ILLINOIS

PLANTS AT: CHICAGO — JERSEY CITY — NEW ORLEANS

pipe as the original pipe one-half the distance between the original stations when the original compression ratio is adhered to. Likewise, if a 50 percent increase is wanted, it becomes necessary to install parallel pipe for three-fourths of the distance.

Under present conditions line pipe is hard to find and if available may be prohibitive in cost, or the physical layout of the line may preclude the laying of loops except under adverse conditions. A midway booster station employing electric motor driven centrifugal compressors has recently been projected in Kentucky to gain an increase in capacity in a certain 24-in. line with original station spacing of about 80 mi., with installed equipment of three 2,000 h.p. motors. The economics of making installations of this nature to increase capacity becomes a problem of comparing the operating expense of the midway electric centrifugal station with the fixed costs of the loops.

The use of centrifugal compressors for main line transmission is apparently feasible economically when capacity factors are less than 100 percent and in the region of 85 percent, to 95 percent, as usually found. Using such compressors for midway booster stations is feasible for lines serving a diversified load of industrial, commercial and domestic business in lieu of installing the complete loop at once, or if used only during winter months.

W. H. Stueve, Oklahoma Gas & Electric Co., before 1947 National Conference on Petroleum Mechanical Engineering, American Society of Mechanical Engineers, Houston, Tex., Oct. 5-8, 1947.

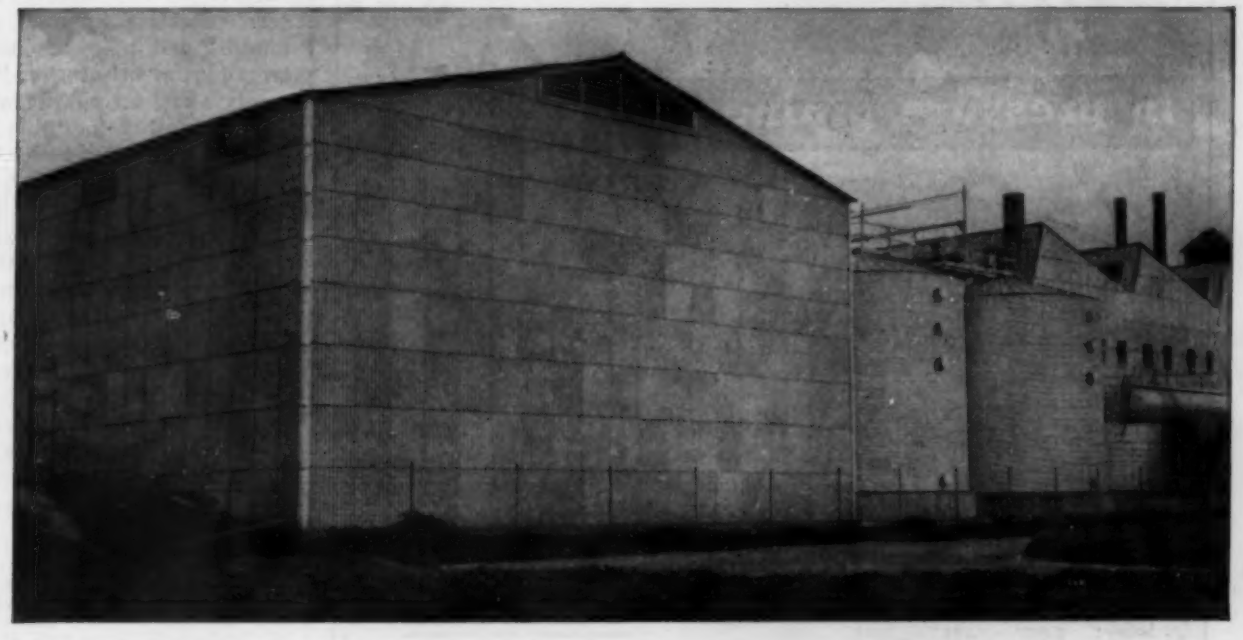
Life of Austenitic Furnace Tubes

Because of scarcity of data on the long-time performance of alloy materials, information on the service life of 18-8 chrome nickel steel tubes in the radiant section of the furnaces of 1,000 psi. ga. thermal cracking units at the Baton Rouge refinery of Standard Oil Co. of New Jersey (La. Division) should be of interest. The data cover 16 years.

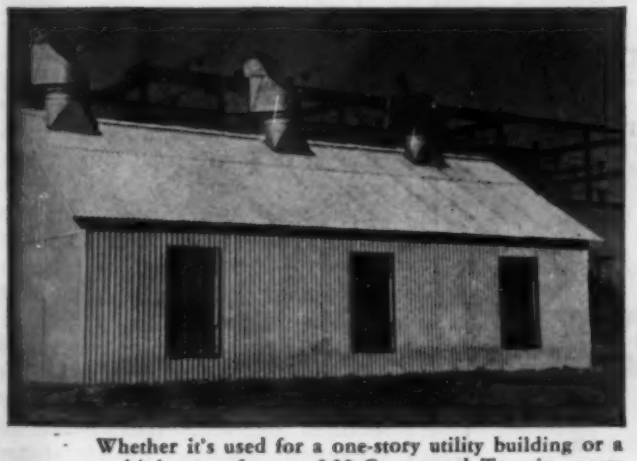
These tubes are of 4,500 in. O.D. x 0.400 in. minimum wall thickness with upset and machined ends. The furnaces operate with normal coil inlet pressures of about 900-1,000 psi, and normal coil outlet temperatures of about 900-1,000 deg. F. Almost from the start of operations in 1931 the tubes were inspected carefully. A card record was set up for each tube, using the heat number and tube number, which are stenciled at each end of the tube, for identification. After about five years of operation a policy was adopted whereby 20 tubes were re-

CORRUGATED TRANSITE* . . . *for the complete exterior*

*Transite is a registered Johns-Manville trade mark



For buildings large and small, industry uses Johns-Manville Corrugated Transite for the entire exterior—roofs as well as side walls. Transite needs no upkeep . . . can't rot . . . can't burn . . . can't rust



Whether it's used for a one-story utility building or a multiple-story factory, J-M Corrugated Transite meets all the modern requirements for attractive design and streamlined construction.

It builds fast! And it's built to last! Corrugated Transite is a rigid asbestos sheet that provides durable, weatherproof walls and roofs for buildings of every size and design.

Whatever your industry, whatever type of building, you can use Transite for both new and remodeled structures, and cut construction costs.

The large convenient sheets, with their unusual strength further increased by corrugations, permit a minimum of framing. They're quickly and easily applied, and when alterations are necessary can be completely salvaged.

You save on maintenance, too. Made of asbestos and cement, practically indestructible materials, Transite requires no preservatives . . . remains virtually maintenance-free.

For more details, write Johns-Manville, Dept. CE-2, Box 290, New York 16, N. Y.

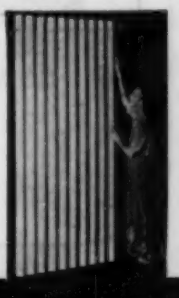
Because of the unprecedented demand for J-M Building Materials, there may be times when we cannot make immediate delivery. We urge you to anticipate your needs.

EASY TO BOLT TO STEEL

EASY TO SAW

EASY TO DRILL

EASY TO NAIL TO WOOD



JM

Johns-Manville *Asbestos* **CORRUGATED TRANSITE**

CUT PIPING COSTS

in pressure piping installations!

use either horizontal or vertical!

CATAWISSA VALVES

DOUBLE EXTRA HEAVY UNION SWING CHECK TYPE, HOT FORGED STEEL

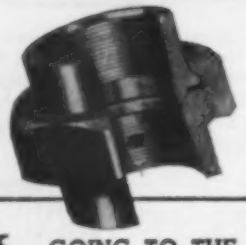
ELIMINATE additional union and nipple on either outlet or inlet end of line!

Efficient, easily accessible, free-moving flapper gives positive 100% opening in high temperature and extreme high pressure applications!

WORKING STEAM PRESSURE UP TO 600-lbs. (1500-lbs. oil, water or gas).

WRITE FOR Bulletin 10-A for the complete story!

Hot Forged Steel UNIONS



- STANDARD . . . for pressures up to 2000-lbs.
- DOUBLE EXTRA HEAVY . . . for pressures up to 6000-lbs.

GOING TO THE INTERNATIONAL PETROLEUM EXPOSITION IN TULSA, MAY 15 TO 22?

Stop in at Booths 28-29 (Oklahoma Building) and let's get acquainted!

CATAWISSA VALVE & FITTINGS COMPANY
100 Mill Street
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CATAWISSA
UNIONS ★ VALVES

moved each turnaround, sandblasted externally, inspected and straightened if necessary and the ends reconditioned if necessary. Gradually the number removed was increased until each tube was removed after six months service. After cracks in some tubes were found, each tube was removed every three months, and tubes are now removed every four months for sandblasting, inspection and reconditioning.

After most of the tubes had 60,000 service hours it was decided that tubes should be retired from service after 60,000 service hours. This decision was based on the increased rate of bulging after 50,000 hr. and the roughened appearance and surface cracks and defects after 60,000 hr. The careful, frequent inspections and the strict adherence to a 1,200 deg. F. tube metal temperature limit has held the number of failures in service to two tubes in 16 years of operation. When tube metal temperatures are approached, the units are shut down for cleaning.

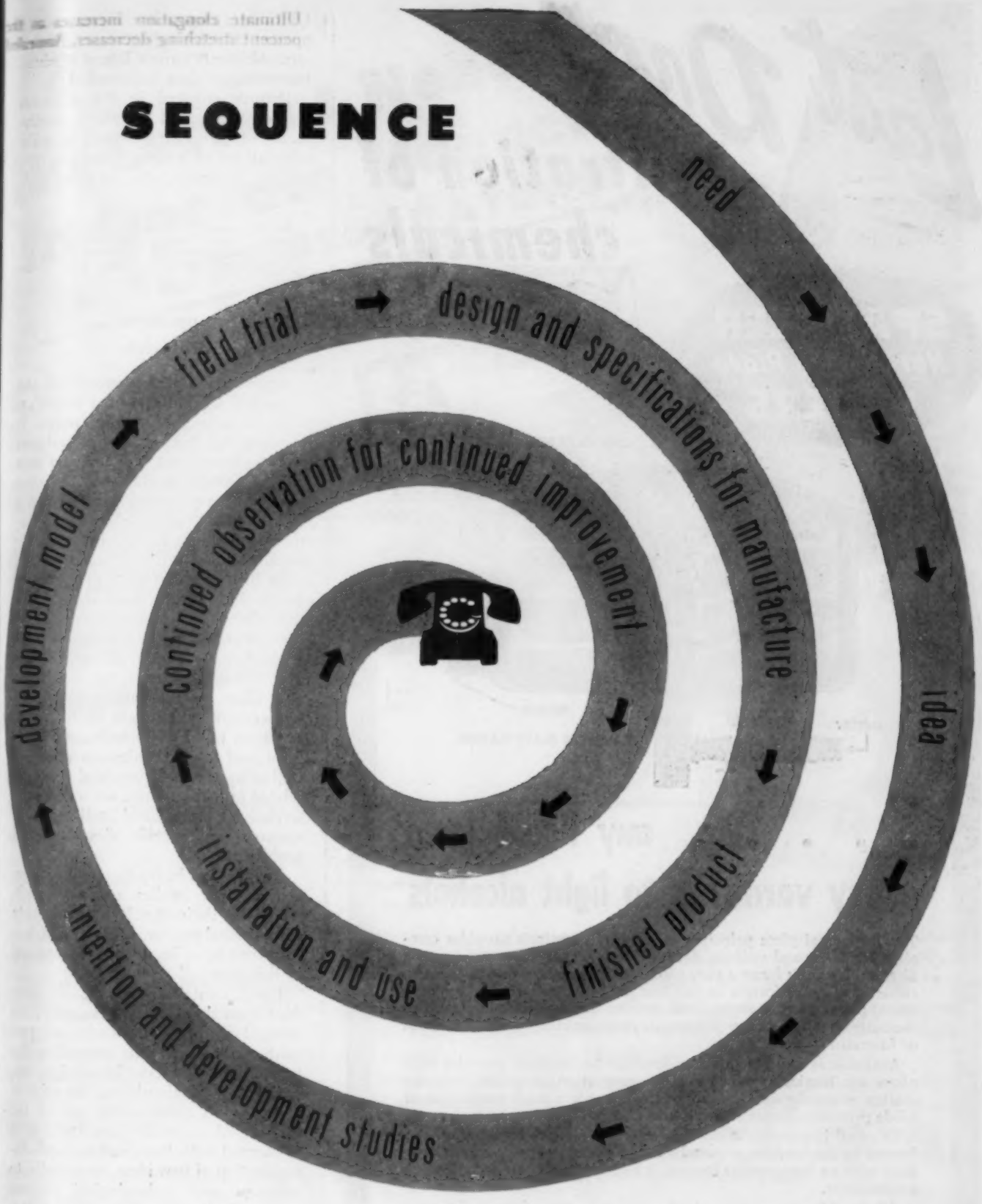
Charles S. Pugsley, Jr., Standard Oil Co. of New Jersey (La. Division), before the 1947 Conference on Petroleum Mechanical Engineering, American Society of Mechanical Engineers, Houston, Tex., Oct. 6-8, 1947.

Plastic Extrusion Applied To Monofilaments

PLASTIC monofilaments are made by extruding plastics through a multiple-orifice die which forms the materials into small diameter rods. These rods are stretched and annealed to produce finished monofilaments. Extrusion, cooling, stretching, and annealing are usually carried out in one continuous operation. Plastic extrusion machines made by various manufacturers differ in special features, but all are essentially screws operating in a close-fitting cylinder with a suitable die fitted adjacent thereto for shaping the extruded product. Proper machine size, good die and head design, and control of the required extrusion temperatures are important factors for satisfactory monofilament extrusion.

Processing techniques and conditions have significant effects on the physical properties of the finished monofilaments. The effects of processing variables on tensile strength, knot strength, ultimate elongation, and percent shrinkage at elevated temperatures of monofilaments made from a vinyl chloride-vinyl acetate copolymer and polyethylene resins show that the tensile strength of the monofilament increases as the percent stretch used to make the monofilament increases, and further increases with moleculer weight of the resins. Knot strength is lower in pounds per square inch than straight tensile strength.

SEQUENCE

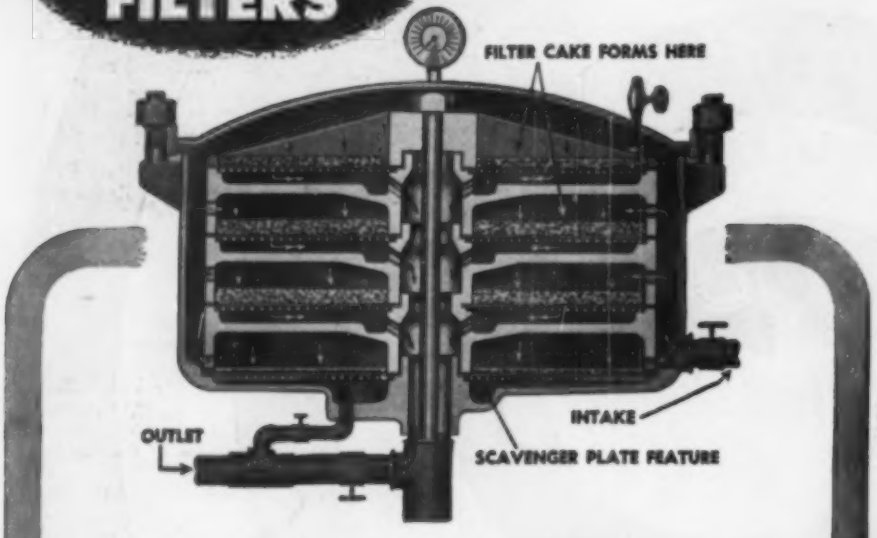


At Bell Telephone Laboratories, more than 2300 scientists, engineers, and their associates are continually exploring and inventing, devising and perfecting for improvements and economies in telephone service.

BELL TELEPHONE LABORATORIES

Last Drop filtration of chemicals with

SPARKLER
Horizontal Plate
FILTERS



. . . . . any liquid from heavy varnishes to light alcohols

The horizontal plate principle of filtering chemicals provides complete flexibility and uniform dependable results. When diatomaceous filter aid is used it forms a pure silica sieve of uniform microsize mesh. Other filter media form a similar firm filter cake on the Sparkler horizontal plates. Flow is always with gravity. The horizontal position of the built-up cake prevents slipping or cracking either with continuous or intermittent flow.

Available in two plate depths, Sparkler construction provides deep plates for liquids carrying a large proportion of solids. Sparkler shallow plates for use on liquids carrying only a small proportion of solids provide a larger filtering area within the same size tank.

Of equal importance is the feature of complete batch filtration performed by the Sparkler patented scavenger plate; virtually an auxiliary filter with an independent control, it filters the very last drop, leaving no holdover.

All Sparkler filters, even the large sizes, can be furnished with a portable base. Standard models available in capacities of 50 G.P.H. to 5000 G.P.H.

Sparkler filtration is Engineered Filtration—we invite correspondence on your problems. You will receive the advice of filtration scientists with a quarter of a century of experience in a specific field.

SPARKLER MANUFACTURING COMPANY
MUNDELEIN, ILLINOIS

Ultimate elongation increases as the percent stretching decreases. Annealed monofilaments shrink less at elevated temperatures than unannealed.

Persons engaged in the extrusion and orientation of circular monofilaments often find it necessary to make calculations of length, extrusion rate, weight, diameters, etc., on their product.

W. F. Hemperly and G. G. Himmler, Bakelite Corp., before Division of Industrial and Engineering Chemistry, American Chemical Society, New York, Sept. 18, 1947.

Industry Support of University Research

SCIENTIFIC research sponsored and supported by industry is a major activity on many a university campus. It is conducted both as an integral part of the educational program and as a special service to industry. Support comes in many forms: As unrestricted gifts, grants-in-aid, industrial fellowships, and the financing of cooperative research projects.

In its return to postwar status, industry has already been turning to the colleges and universities for assistance in solving its reconversion problems. Unable to provide within their own resources means for producing new ideas for the improvement and replacement of obsolete facilities and processes to meet postwar conditions, large and small businesses alike, as well as trade associations and groups of related industrial firms, are seeking the services of educational institutions in research on specific developmental problems.

Despite the heavy teaching load resulting from swollen postwar enrollment and their own lack of adequate instructional personnel, educational institutions have been quick to respond to this new call upon them.

Fundamentally research is conducted on the university campus as an integral part of the educational program, with a view to expanding the frontiers of human knowledge, encouraging and stimulating the spirit of inquiry, and contributing toward the training of scientific personnel. It is concerned with the discovery and dissemination of new ideas, so essential to scientific and technological progress and to cultural and social development.

Administrators and scientists concerned with the formulation and conduct of university research programs recognize many of the problems inherent in cooperative research, sponsored and supported by outside agencies. They are anxious to resolve differences of view and reach an agreement among the parties concerned so

No Current Needed to Operate Magnets IN ERIEZ SEPARATORS

Here's a *safe, economical way* to separate magnetic from non-magnetic materials . . .

Non-electric units such as the Eriez pulley shown here, are widely used for removing ferrous particles from flows of granules, fibers, powders and liquids in the food, textile, oil, chemical, and scores of other industries.

To extract ferrous materials ranging in size from minute particles to large nuts, bolts and similar pieces of tramp iron, Eriez Manufacturing Company, Erie, Pa. has developed pulleys, drums, plates and traps with exceptionally strong magnetic fields . . . by building into these units Alnico permanent magnets which contain a high percentage of Nickel.

The powerful magnetic properties of Alnico, an aluminum-Nickel-cobalt-iron alloy, permit designing of permanently magnetized separators that eliminate the need for electromagnets which require a direct current and accessory equipment. Moreover, this Nickel alloy suffers no loss of magnetism in operating conditions up to 600°F. . . . nor is it affected by moisture or wet materials.

Alnico is only one of many different Nickel alloys used to meet exacting demands in the chemical and process industries. We invite inquiries regarding Nickel or Nickel alloys for specific applications to improve your products or equipment.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, copper-base and other alloys containing Nickel. This information is yours for the asking. Write for "List A" of available publications.

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How often do you stop your filter presses

— to wash filter fabrics that are clogged and gummed?

— to replace weakened, torn filter fabrics?

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Impregnated Filter Fabric

- Resists corrosive action of Alkaline and Caustic solutions.
- Mildew and rot resistant.
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- May be used in cold or boiling filtrations.
- May be used with hydrocarbon solvents.
- Better filtration.
- Soft, flexible—sews easily.

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Information and samples on request.

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that all our research resources in personnel and facilities may be fully utilized, with a proper allocation of function. Only through free and friendly discussion of the implications of the present involved situation can that end be attained.

Archie M. Palmer, National Research Council, before Association of Consulting Chemists & Chemical Engineers, New York, Oct. 28, 1947.

FOREIGN LITERATURE ABSTRACTS

Synthesis of Alkylbenzenes and Alkylchlorbenzenes

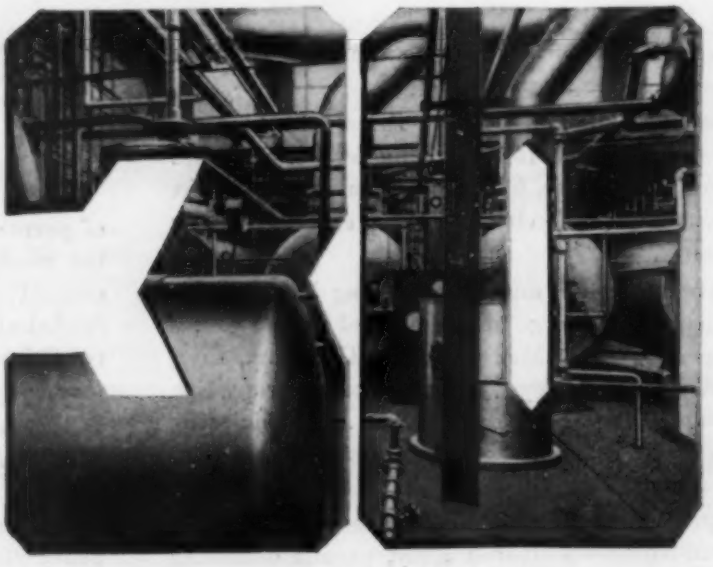
BENZENE, toluene, naphthalene and chlorbenzene can undergo nuclear alkylation with alcohols in the presence of zinc chloride and hydrogen chloride at 140-190 deg. and normal pressure. The yields of monoalkyl derivatives amount to 50-70 percent of the theoretical under these conditions. The reactions take place only at sufficiently high temperatures, wherein they differ distinctly from similar reactions in the presence of aluminum chloride. The guaiacol nucleus can be alkylated with alcohols in the presence of zinc chloride at a temperature of 170-180 deg. These reactions result in monoalkylguaiacols in yields of 60-65 percent of the theoretical and small amounts of ethers. The primary radical of propyl alcohol remains unchanged in alkylation. o-Ethylguaiacol, o-propylguaiacol, amylguaiacol, as well as their acetates and ethers, were obtained and a description is given of their properties.

Digest from "Alkylation of Aromatic Compounds in the Presence of Zinc Chloride. I. Syntheses of Alkylbenzenes and Alkylchlorbenzenes," by I. P. Zuckervanik. "II Syntheses of Alkylguaiacols" by I. P. Zuckervanik and V. Sergeeva, *Zhurnal Obshchei Khimii* 17, 1005-1014, 1947. (Published in Russia.)

Calorific Value of Argentine Coals and Asphaltites

AVERAGE calorific value of typical Argentine coals was found to be practically identical with that of the better coals of England and the United States, considered on the basis of pure carbon in accordance with Parr's correction formulas. The samples were taken from the following provinces or territories of Argentina: Jujuy, Salta, La Rioja, San Juan, Neuquen, Chubut, Rio Negro, Santa Cruz, and Tierra del Fuego. When properly purified, these coals yield a product containing

1918-1948



30 YEARS

Starting in Barnebey—Cheney Engineering Co. and expanding into American Solvent Recovery Corp. Recovery Plants have been installed throughout the years in the basic industries of America.

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Heavy power-transmitting pressure on the friction disc is developed by a circle of hardened steel balls which are forced into a wedge-shaped groove by the sliding cam.

The "wedge" of cam and groove contours multiplies the force exerted on the shifter collar into a powerful force on the friction disc.

Engagement is easy and positive —smooth as a rolling ball. Great flexibility, ease of control and extreme ruggedness are provided in this modern, compact unit.

Available in Bolted Plate or Gear Tooth Plate series—in sizes from .38 H.P. to 21.2 H.P. at 100 R.P.M. Write for special bulletin, A282.

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Mishawaka, Indiana

ROLLING GRIP CLUTCH

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of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

He is your local Dodge Distributor—factory trained—qualified to suggest ways to improve your machine performance, increase production. Look for his name under "Power Transmission Equipment" in your classified phone book.

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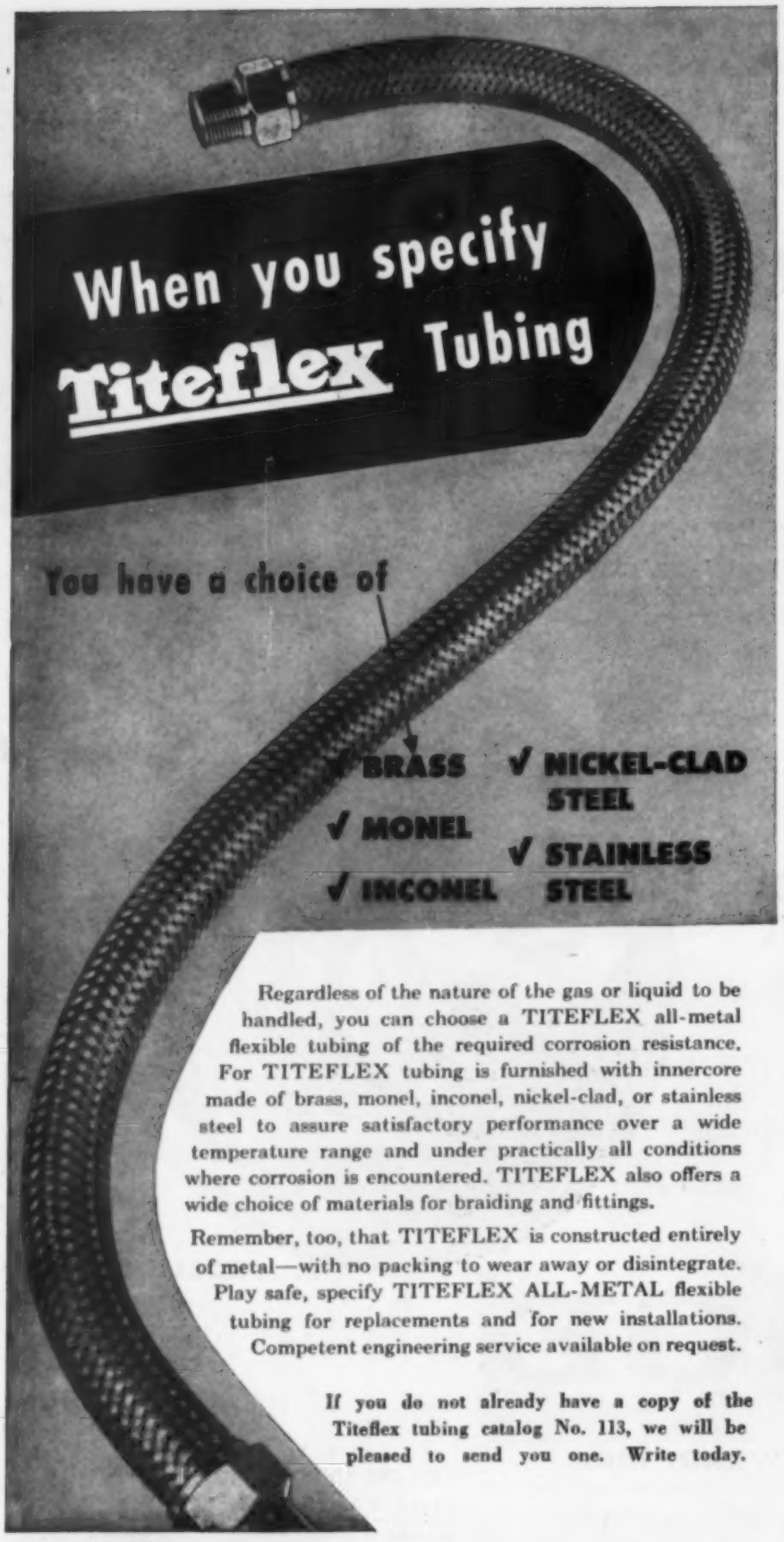
FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS



Regardless of the nature of the gas or liquid to be handled, you can choose a TITEFLEX all-metal flexible tubing of the required corrosion resistance. For TITEFLEX tubing is furnished with innercore made of brass, monel, inconel, nickel-clad, or stainless steel to assure satisfactory performance over a wide temperature range and under practically all conditions where corrosion is encountered. TITEFLEX also offers a wide choice of materials for braiding and fittings.

Remember, too, that TITEFLEX is constructed entirely of metal—with no packing to wear away or disintegrate. Play safe, specify TITEFLEX ALL-METAL flexible tubing for replacements and for new installations. Competent engineering service available on request.

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as little as 15 percent impurities (moisture and ash) resulting in bituminous coals with an average calorific value of more than 7,200 cal. The asphaltites which occur in abundance in Argentina in the region south of Mendoza and north of Neuquen are a superior fuel with an average calorific value 8.50 percent higher than that of the better coals of England and the United States, compared on the basis of pure carbon. In its natural state its calorific value is approximately 11 percent higher than that of the coals coming from those two countries. This gives an idea of its exceptional purity. An equal mixture of such asphaltites with Argentine bituminous coals results in a product with a calorific value of 8,143 cal. The asphaltite deposits are located in a favorable geographic area in relation to that of bituminous coals of the highest calorific value, which would favor the production of such aglomerates.

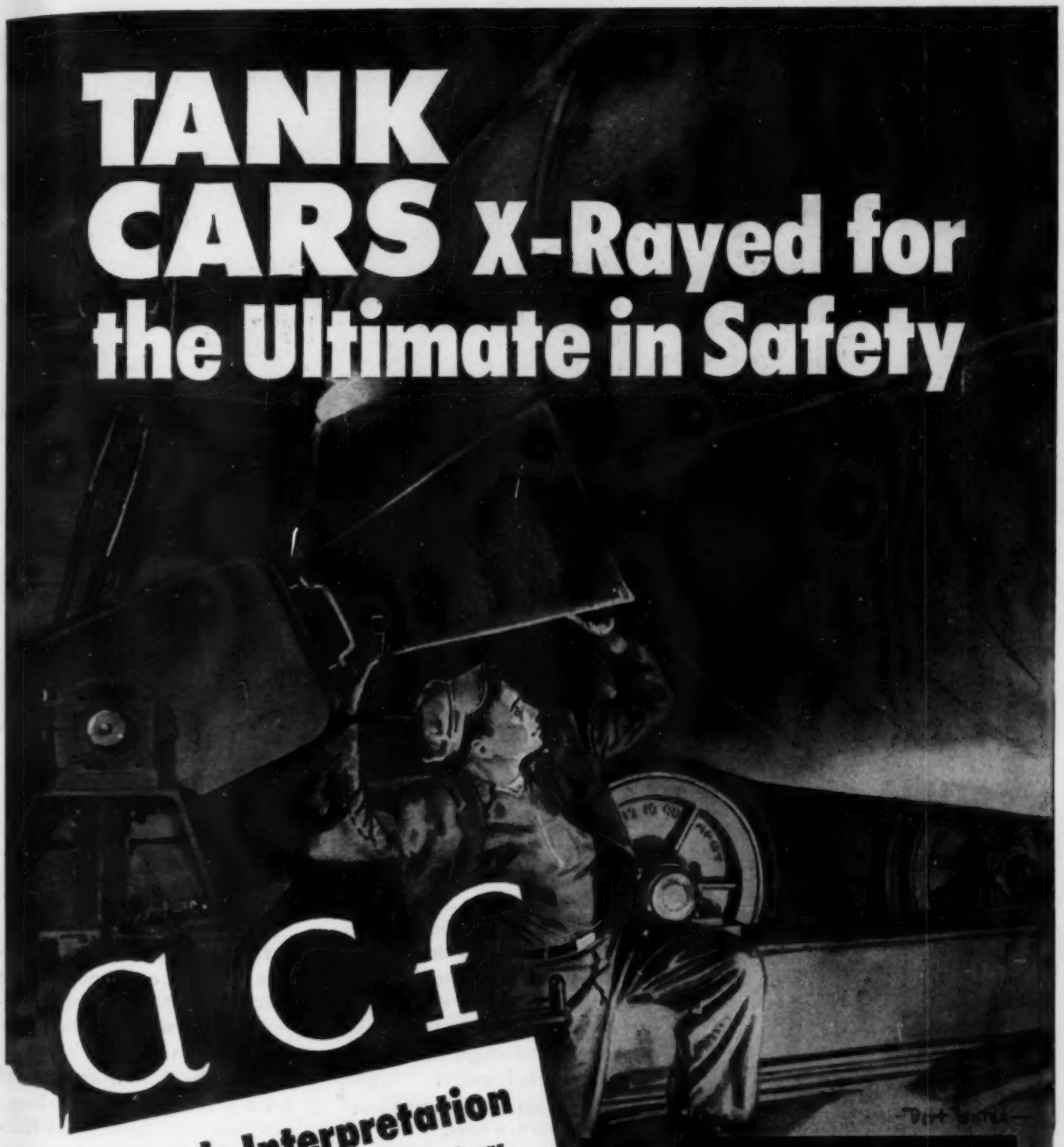
Digest from "Calorific Value of the Typical Coals and Asphaltites of Argentina" by Jorge R. Azcuenaga, *Industria Minera* VI, No. 72, 19-33, 1947. (Published in Argentina.)

Chromium in Steel Manufacture, Thermochemical Behavior

CHROMIUM used in steel manufacture with electric arc furnaces imparts desirable properties to the steel products if it is present in the charge in sufficiently high concentrations and the process is conducted under properly controlled conditions. Thermochemical data were collected on the basis of work with 100 castings made with charges having a high chromium content. It had been reported in earlier literature that it is difficult to make castings if the charge contains chromium in concentrations above 0.5 percent. A higher percentage than this is supposed to be accompanied by the presence of high concentrations of chromium oxide in the scoria which increases the viscosity of the latter to such a degree that it hinders working of the bath and results in products with poor mechanical properties. A. Bargone disagrees with this statement, having successfully used concentrations of up to 2.5 percent chromium. Such deficient mechanical properties are the result of oxidation of the chromium and not to the presence of high concentrations of this metal in the charge. Good results can be obtained by conducting the process at a very high temperature, by limited use of iron mineral and by production of a limited quantity of scoria.

Digest from "Thermochemical Behavior of Chromium in the Process of Steel Manufacture in Electric Arc Furnaces" by Agostino Bargone, *Tecnica Italiana* II, No. 1, 17-122, 1947. (Published in Italy.)

TANK CARS X-Rayed for the Ultimate in Safety



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Radiograph Interpretation

plays an important role in A.C.F. tank car building. Standards for all cars built to I.C.C. specifications, are set well above regulations. A.C.F. tanks are also subject to exacting tests for elongation, tensile strength across the weld, and consistency of the weld itself, resulting in tank cars that can take it! It's only natural that when you think of high-quality tank cars, you think of A.C.F.

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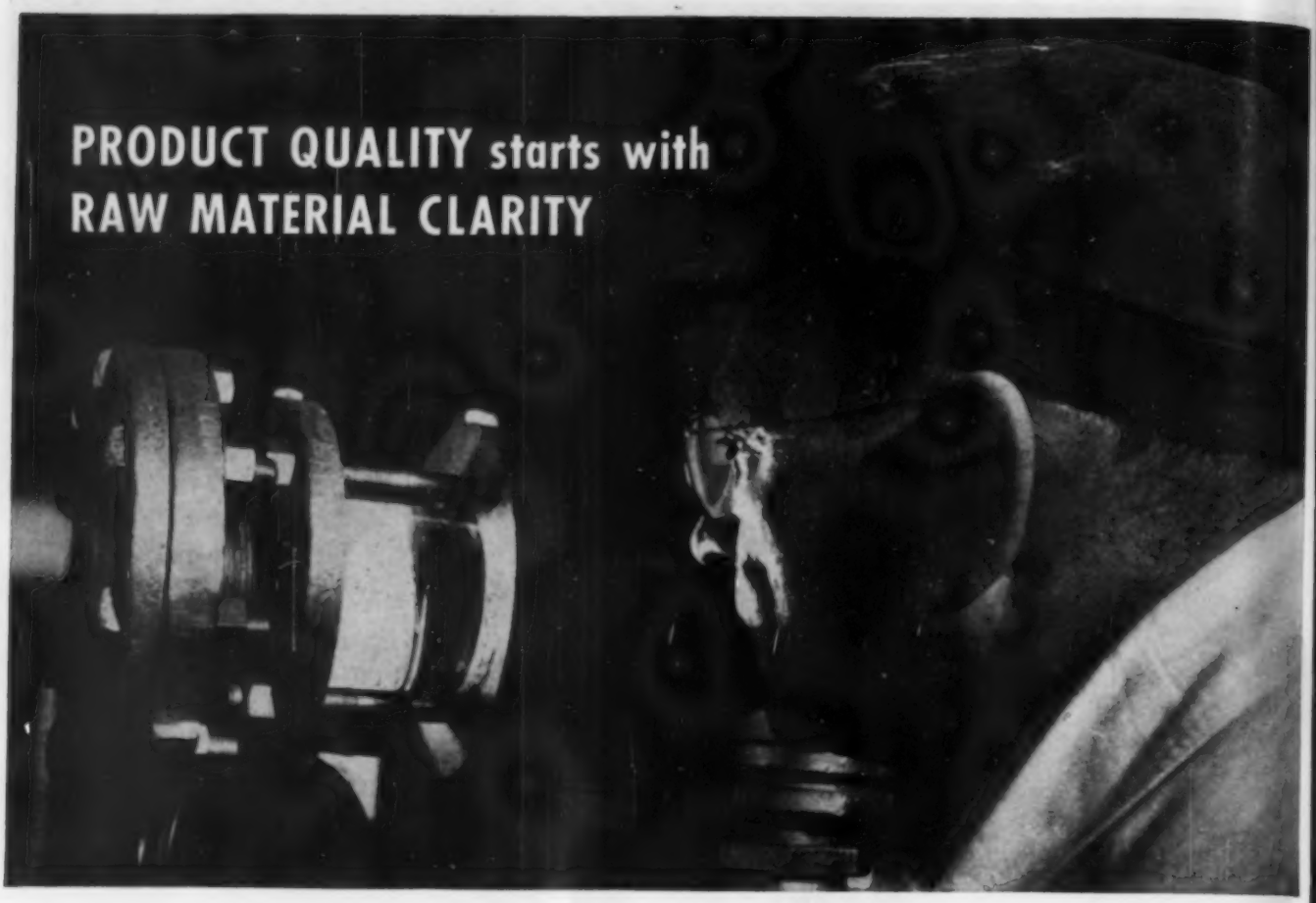

Filter with CELITE* to improve both product and process at low cost

THE CAKE not the cloth DOES THE WORK

These two photomicrographs show that a Celite filter cake (left) has smaller openings than the finest filter cloth (right). It is the filter cake—not the cloth—that removes the suspended impurities.

When Celite clarifies the raw materials—filters out impurities—you gain greater process stability . . . get a better product at lower cost. At any process stage, Celite filtration costs less because:

Celite produces the clearest filtrates at the fastest flow rates.

Celite retains up to 10 times its own weight of impurities—which enables you to make longer filtering runs. You filter more liquid with fewer shutdowns.

Filtering is done by the skeletons of fossilized diatoms—35,000,000 to the cubic inch. These tiny particles interlace and overlap to form a screen that traps out all suspended impurities. The cake Celite builds up on the filter cloth also protects the cloth from gums and harsh particles. This means longer life from filter cloths, less cleaning and maintenance.

Celite is available in grades to cover every filtration requirement. For more detailed information, write Johns-Manville, Box 290, New York 16, New York.

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Johns-Manville *Celite* **Filter Aids and Fillers**

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

For Popular Consumption

ATOMICS FOR THE MILLIONS. *By M. L. Eidinoff and H. Richlis. Whittlesey House, McGraw-Hill Book Co., New York. 281 pages. $3.50.*

Reviewed by J. E. Underwood

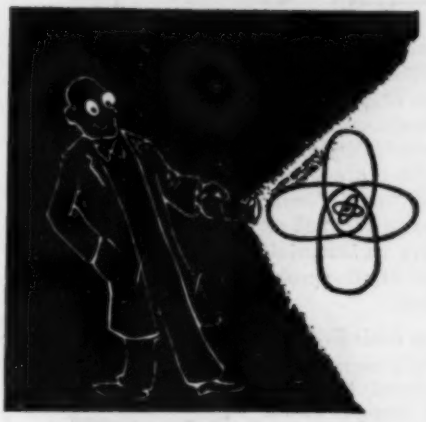
A SUCCESSFUL attempt by a chemist and a physicist to present a chronology of the evolution of atomic concepts from the earliest philosophical ideas to the recent discoveries involving nuclear energies and the utilization of sub-atomic forces. Although written in a somewhat popular vein and for popular consumption the material presented adheres closely to the experimental facts which have led to our present knowledge. A large number of somewhat humorous line drawings and diagrams assist in obtaining a better understanding of the text. Considerable space is given to the evolution of the atomic bomb but in justification it must be remembered that this "fantastic and most terrible of all human inventions" is the result of man's attack on the forces of nature and his spectacular use of nuclear energy. The authors conclude with some philosophical considerations regarding the utilization and control of nuclear energy and the difficulties confronting the present generation in making the decisions which will advantageously affect the world to come.

Echoes of the War

DIARY OF DEMOCRACY: THE SENATE WAR INVESTIGATING COMMITTEE. *By Harry Aubrey Toulmin, Jr. Richard R. Smith, New York. 277 pages. $3.50.*

Reviewed by H. C. Parmelee

SENATE investigating committees are seldom eulogized, especially years after their work is done. Usually their transitory fame and reputation are embalmed with their work in thousands of pages of testimony neatly printed, bound, and stacked on library shelves. Nor is any good purpose usually served by exhuming the record and reviewing it for public consumption. But Col. Toulmin has made out a pretty good case for both eulogy and review of the work of the Senate War Investigating Committee of World War II, otherwise known as the Truman Committee.



Science throws light on the atom
(From "Atomics for the Millions")

The reason for eulogy is suggested by the title of the book, Diary of Democracy. The author regards the organization, policy, and procedure of the committee as indisputable evidence of democracy at work day by day. The committee not only preserved the traditional peacetime checks and balances of our form of government while the country dedicated itself to war, but it acted also as a coordinating agency that actually developed team work among the executive, legislative, and judicial branches of the government. War greatly multiplied the problems of democratic government, but democracy was preserved in the face of an enemy that boasted totalitarian power. And, in the eyes of the author, the Truman Committee was one of the instruments of that preservation. Its door was open to the lowliest citizen; its criticism was directed against the highest authority. Further, he believes that the committee's accomplishments have set a pattern for peacetime investigations by the Senate—non-partisan, non-political, impartial, constructive, fearless. The welfare of the country and the winning of the war at the lowest cost of men, money, and materials were the criteria of its judgments. If, at times, the author seems too fulsome in his praise and commendation of Mr. Truman and the committee, he nevertheless has a mass of evidence to support his views.

After discussing the personnel of the committee, its organization, policies, and plan of operation, the author devotes the bulk of his volume to a digest of the major investigations —cantonments, metals, rubber, shipping, manpower, petroleum, aircraft, and other related matters. To those who were fairly close to the conduct of the war, the record of waste, graft, dishonesty, incompetence, inefficiency, stupidity, greed and selfish interest are an old story, but it will be a revelation to many who had little contact with official matters. Men who were in the armed services will read it with a new understanding of conditions about which they griped but which they could not comprehend.

When the author expresses the hope that the lessons learned through the Truman Committee will be remembered and used in a future war, he is on debatable ground. Many of the lessons from the first World War

RECENT BOOKS RECEIVED

Audiovisual Aids to Instruction. By W. Exton, Jr. McGraw-Hill. $4.

Chemical Architecture. Ed. by R. E. Burk & O. Grummit. Interscience. $4.50.

The Elements of Fuel Technology. By G. W. Himus. Leonard Hill.

Elements of Nomography. By R. D. Douglass & D. P. Adams. McGraw-Hill. $3.50.

The Essential Oils. Vol. I. By E. Guenther. Van Nostrand. $6.

Factual Communication. By L. O. Guthrie. Macmillan. $3.50.

Heating and Ventilating's Engineering Databook. By C. Strock. $7.

Life, Its Nature and Origin. By J. Alexander. Reinhold. $5.

A National Policy for the Oil Industry. By E. V. Rostow. Yale. $2.50.

Nomography. By A. S. Levens. Wiley. $3.

Organic Analytical Reagents. Vol. IV. By F. J. Welcher. Van Nostrand. $8.

Plastics Dictionary. By T. A. Dickinson. Pitman. $5.

SPI Handbook. Ed. by N. J. Rakas. Society of the Plastics Industry. $7.50.

Surface Chemistry for Industrial Research. By J. J. Bikerman. Academic. $8.

The Systematic Identification of Organic Compounds. 3rd ed. By R. L. Shriner & R. C. Fuson. Wiley. $4.

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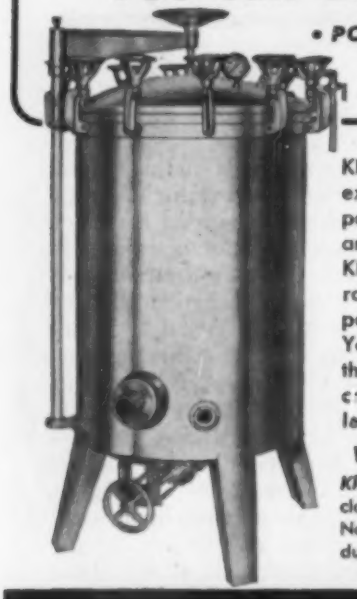
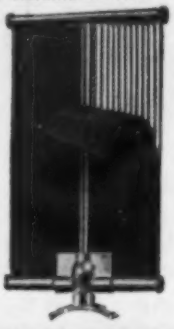


Klein Ideal Diatomaceous Earth Filters and the exclusive Klein Filter Leaves, in combination, assure positive filtration at all times. Operation, cleaning and maintenance costs are at a minimum with Klein Filters. In addition, many radical innovations are incorporated in Klein Ideal Filters. You'll want to know about all of these if you have an industrial, chemical or food filtration problem in your plant.



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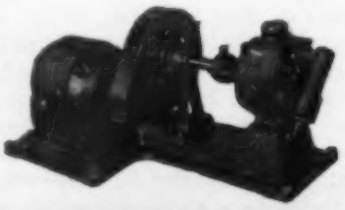

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were recorded with the same pious hope, and the men who learned them were available in the second great conflict but were quietly ignored. Furthermore, West Point and Annapolis will continue to turn out men trained in the art of war, but wholly incompetent to handle the tremendous business and industrial problems that are inseparable from modern warfare. Maybe a new generation will be wise enough to select a high business command as well as a high military command to run a war, but the odds are in favor of muddling through as we have in the past. In these matters men seem to learn stubbornly from their own experience, not that of others.

Tripartite

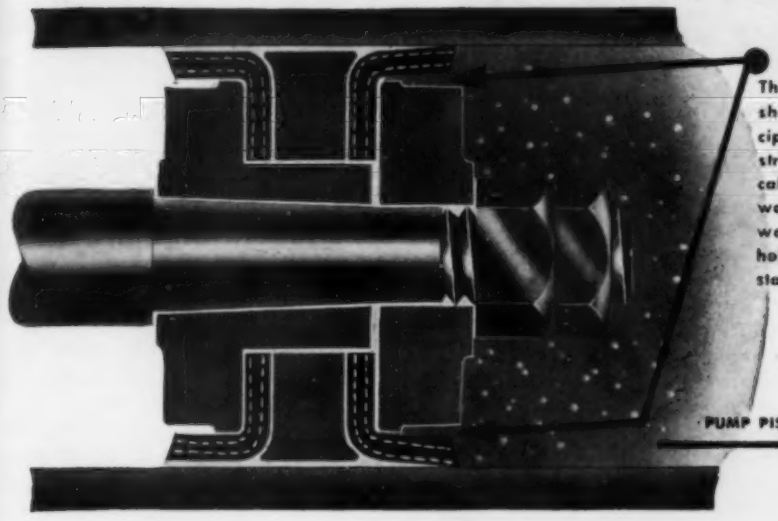
POWDER METALLURGY—PRINCIPLES AND METHODS. *By Henry H. Hausner. Chemical Publishing Co., Brooklyn.* 307 pages. $7.

Reviewed by Myron A. Coler

DR. HAUSNER'S book is an unusual combination of an elementary text, a reference digest and a handbook. It is made up of three fairly distinct parts. Part I contributes a general background. The dominant chapter of this part, entitled "Principles," gives schematic descriptions of the chief processing operations and indicates in a semiquantitative manner the trends normally encountered with variations of the major processing variables. The remaining chapters of Part I provide a glossary, descriptions of metal powder types, their manufacture and applications and a comparison between the properties of sintered metals and the corresponding fused products.

Part II, "Graphs and Tables on Powder Metallurgical Methods," occupies about one third of the volume and shows by means of grouped specific examples the effects of the chief processing variables on the properties of the resulting compacts. The principal variables covered include: effects of composition, particle size, compacting pressure, sintering conditions and subsequent working on physical properties. The specific data are presented in the form of over one hundred graphs and tables; most of the data are conveniently keyed to the bibliography of Part III.

Part III provides a substantial chronological bibliography of over 1,000 references ranging from 1800 through 1945 and comprises almost half of the book. The selection is not limited to immediate powder metallurgy applications but includes a large number of peripheral references such as those dealing with bronzing pow-



This greatly exaggerated diagram shows the Darcova Pumcup principle. On pressure side of each piston stroke, flexible Pumcup is automatically forced against liner or cylinder wall. Firm, uniform contact all the way around eliminates slippage, holds volumetric efficiency at constant high in spite of gradual wear.

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ders for organic finishes, discharge of colors by zinc dust in textile printing and general metallurgical considerations. The bibliography refers chiefly to the periodical literature; references to the rather extensive patent literature are omitted. Foreign periodicals, including the less familiar ones, are well represented. The value of the bibliography is enhanced by the inclusion of titles and translations of most of the foreign titles as well as indexes.

There are a few slips and unhappy phrases, e.g., hydrogen reduction and hydride formation are repeatedly referred to as "hydration," the table reference on Fernico does not tally. The sections on metal powders are somewhat sketchy. However, viewed as a whole, the volume should prove useful to those desiring an elementary presentation by virtue of Part I and should be of value to those requiring specialized information and reference material in handy form by virtue of Parts II and III. The intensive and intelligent use of tables and graphs with running comments to convey a great deal of information with a minimum of verbiage is to be appreciated.

For Manufacturers and Molders

SPI HANDBOOK. *Society of the Plastics Industry, Inc., New York.* 451 pages. $7.50.

Reviewed by Roger Williams, Jr.

THE NEW handbook published by the Society of the Plastics Industry is a monumental and readable compilation of plastics facts. Its data are mainly concerned with molding and fabricating techniques. As such its interest to the average chemical engineer is slight. The designer of equipment which uses plastic parts will find its sections on design of particular interest. The editors have attempted a new classification of plastic materials by code. Such an effort will be of real value to the users of resins if it is adopted by the industry as a whole. This classification and the section on testing of plastics make the handbook indispensable to the manufacturer of plastic materials.

Rare Instance

HIGH VACUA—PRINCIPLES, PRODUCTION, AND MEASUREMENT. *By Swami Jnanananda. D. Van Nostrand Co., New York. 310 pages. $5.50.*

Reviewed by F. C. Nachod

A REVIEWER'S life is not all pleasure. He often has to plow through books which he believes should not have been written and at the end he is still aware that he should say a few kind

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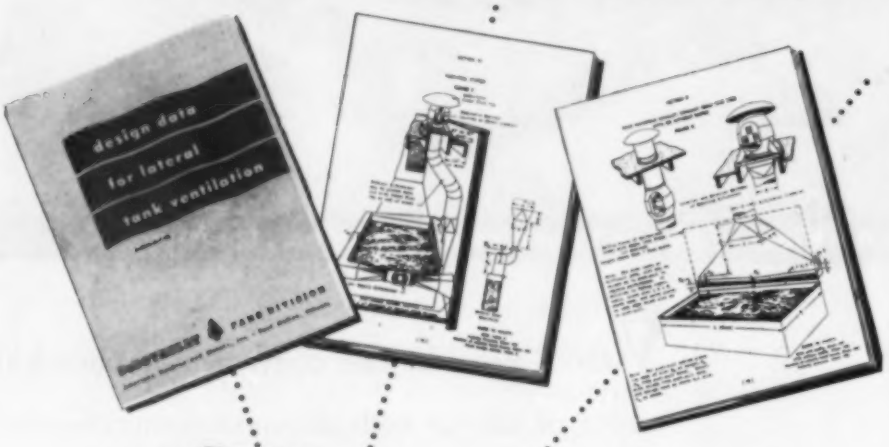

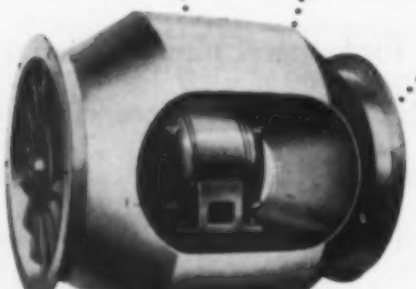

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things about them. It is rare indeed that a reviewer can go all out in praise and recommend a text which he has enjoyed, which he knows others will enjoy likewise and which will be a lasting literary monument.

Dr. Jnanananda's text is such a rare instance of a really perfectly balanced textbook. It combines sound instruction in the theory combined with expert advise on practice, equipment and techniques.

The text is organized in six chapters: Kinetic theory as the basis of the science of high vacua; vacuum pumps or generators; measurements of pressures of high vacua; the technique of high vacuum; preparatory operations for vacuum work; production of high vacua by physical-chemical methods.

It is admitted that some of the practical aspects of high vacua can also be found in standard works such as Ostwald-Luther-Drucker, or Reilly and Rae, but in no instance known to this reviewer has the field been covered so completely.

As said before, really outstanding books "happen" only once in a long while. If and when one comes out, teacher and researcher both better go at it and enjoy it. Orchids are due to a scholar, Dr. Jnanananda.

How to Become an Executive

DEVELOPING YOUR EXECUTIVE ABILITY. *By Howard Smith. McGraw-Hill Book Co., New York. 225 pages. $2.50.*

Reviewed by Chaplin Tyler

"DEVELOPING YOUR EXECUTIVE ABILITY" is a compact, highly practical treatise, replete with numerous illustrative biographical extracts. The author first points out that in order to advance, an executive must have a real burning desire to go places, must not worry about being too inexperienced, and must have the courage to assume greater responsibility. Stress is then put on what the author calls "executive personality" which seems to boil down to qualities that make for good relations with people.

Besides being adept at getting along well with people, and having a desire to assume responsibility, the aspiring executive should learn how to think analytically and to communicate ideas effectively. The author wisely points out that the good executive does not try to do everything himself but is primarily a planner, organizer, coordinator, teacher, and general all-around spark plug.

Near the middle of the book, Mr. Smith includes a check list of 31 questions by which the reader can rate himself as to executive capacity, a perfect score being 1,000 points. This is

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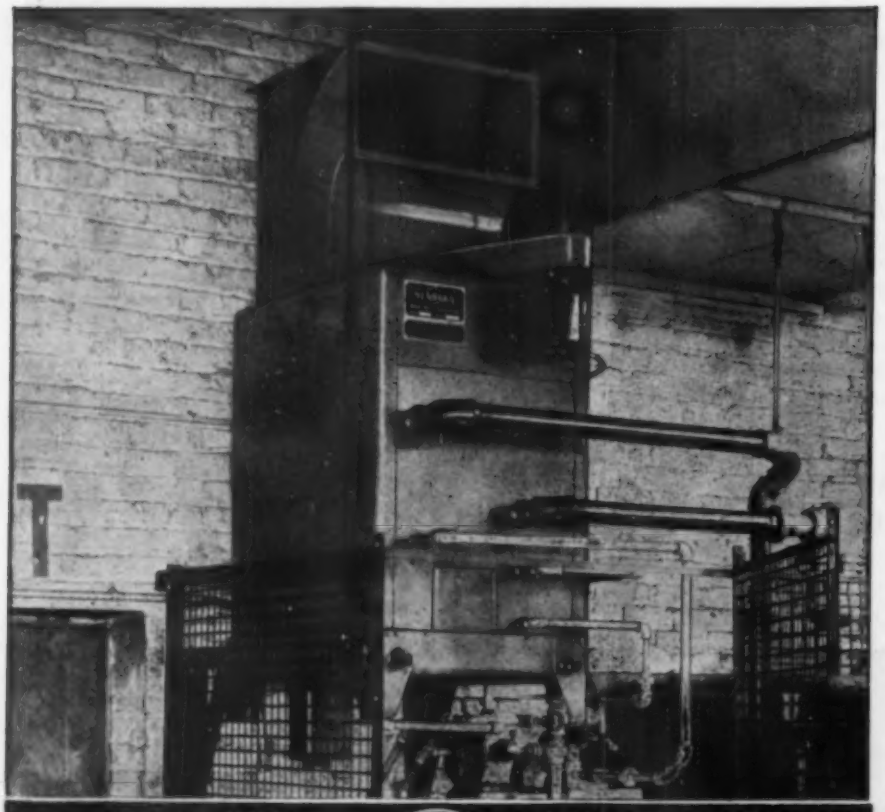

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the only part of the book which failed to enthuse the reviewer: The questions seem altogether too numerous and in instances not too meaningful. Moreover, the idea of a "formula" seems rather futile. However, this is only a minor point of controversy in a book which as a whole the reviewer found interesting, thought-provoking, and extremely well written.

Carbon and Nitrogen

THE CHEMISTRY OF ORGANIC CYANOGEN COMPOUNDS. *ACS Monograph 105. By Vartkes Migrdichian. Reinhold Publishing Corp., New York. 460 pages. $12.*

Reviewed by G. B. L. Smith

DR. MIGRDICHIAN has made an important and useful contribution to the literature of organic chemistry in making available to his colleagues the results of his exhaustive survey of the chemistry of organic cyanogen compounds. The book is concerned primarily with the chemistry of cyanogen compounds and within the limitation of a book of reasonable size the "determined effort to cover the subject in a comprehensive manner" has met with commendable success.

The book has been written from the point of view of the classical organic chemist as we know this person today. Modern concepts of structure are not considered to any extent. However, a vast amount of factual information is presented and in the opinion of the reviewer, the organization is logical and satisfactory.

Since the book covers a part of organic chemistry which is as old as organic chemistry itself (dating from Justus von Liebig) the points of view have changed with the development of the science. It is to be regretted, however, that certain important theoretical developments have been almost entirely overlooked. The name of E. C. Franklin, whose contributions to the rationalization of the chemistry of compounds of nitrogen have been of outstanding and peculiar value to this phase of organic chemistry, does not appear in the index and the reviewer has failed to find any mention of these concepts in the text. The same is true of Louis Kahlenberg, who long ago pointed out the interesting properties of anhydrous hydrocyanic acid as a solvent. (The dielectric constant of this liquid is higher than that of water.) The author, in Chapter 4, "Aminolysis of Nitriles," includes not only aminolysis reactions but also amination, ammonolysis, and ammonation. The dimer of cyanamide is written both "dicyandiamide" and "dicyanodiamide." The author favors the unsymmetrical rather than the

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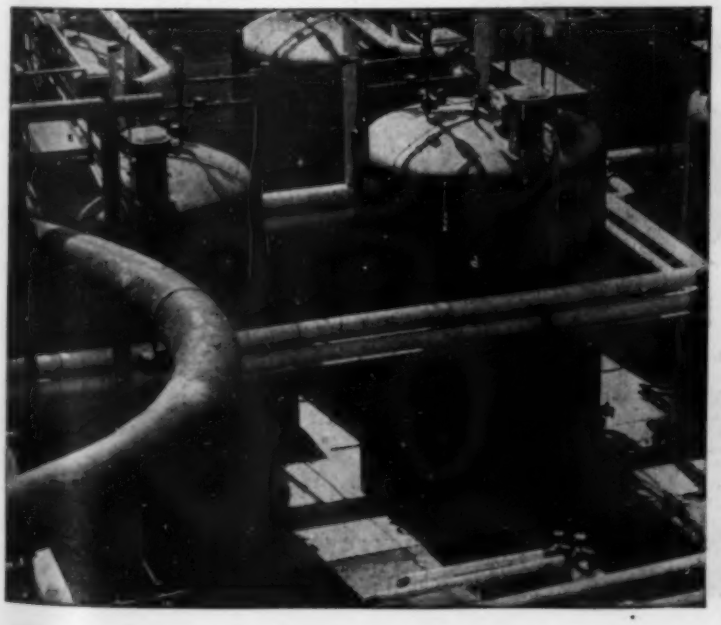

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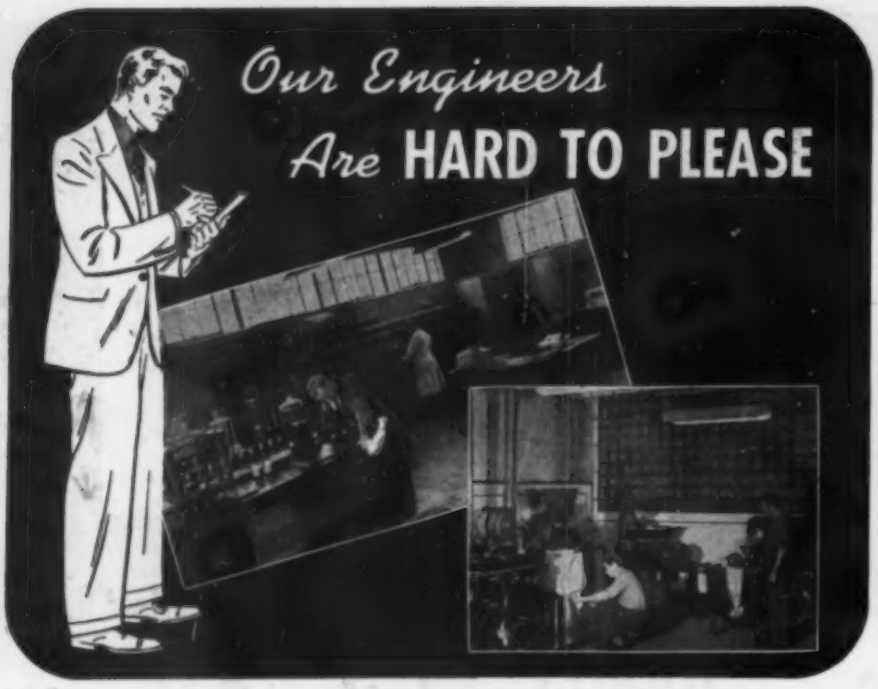

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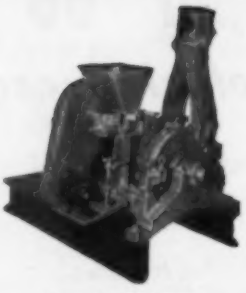

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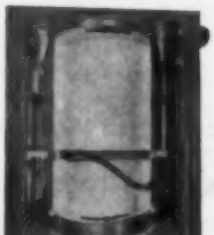

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symmetrical formula of cyanamide in spite of the fact that most recent work indicates that the latter best represents the structure and this has been confirmed by x-ray diffraction studies. These comments, of course, reflect the interests of the reviewer and are not made for the purpose of detracting from the outstanding merits of the book.

Because of the very large field presented in the monograph and because of the fact that cyanogen compounds are not only important compounds per se but also are of great usefulness as intermediates in many syntheses, the reviewer believes that this book will make a welcome addition to the reference library of all nitrogen chemists and also to that of most organic chemists.

Kettletending

SYNTHETIC RESIN CHEMISTRY FOR STUDENTS. *By S. R. W. Martin. Chapman & Hall, London. Price 15s.*

Reviewed by J. J. Mattiello and Narendra Bhow

MANUFACTURE of synthetic resins is an intricate process. A sound knowledge of chemistry of these resins becomes very helpful to people working in this industry. In spite of there being many good books on this subject, Dr. Martin's is a welcome addition to the list because it is primarily intended as a textbook for the average laboratory assistant, resin chargehand, and students of resin, paint and plastics technology. It serves an excellent purpose from this point of view. It will also be found useful and interesting to those who join the resin industry straight from universities.

Giving a very brief idea of organic chemistry, the author covers, in this small book, rosin and its derivatives, phenol-formaldehyde and modified phenolic resins, amino, alkyd, maleic anhydride, polyamide and ethanoid resins. The preparation of each resin is presented very systematic. It is divided in two sections; (a) theoretical considerations and (b) practical considerations. This is the type of presentation usually employed for studying chemical reactions in laboratories. The author also explains very briefly, the fundamentals of Kienle's functionality theory. At the end, he devotes one chapter to analytical methods.

On the whole, this is an excellent book for laboratory workers. Due to the rapid advances in resin chemistry, it is rather difficult to write a simple, explanatory book on this subject, covering the fundamentals, for those who do not possess higher training in

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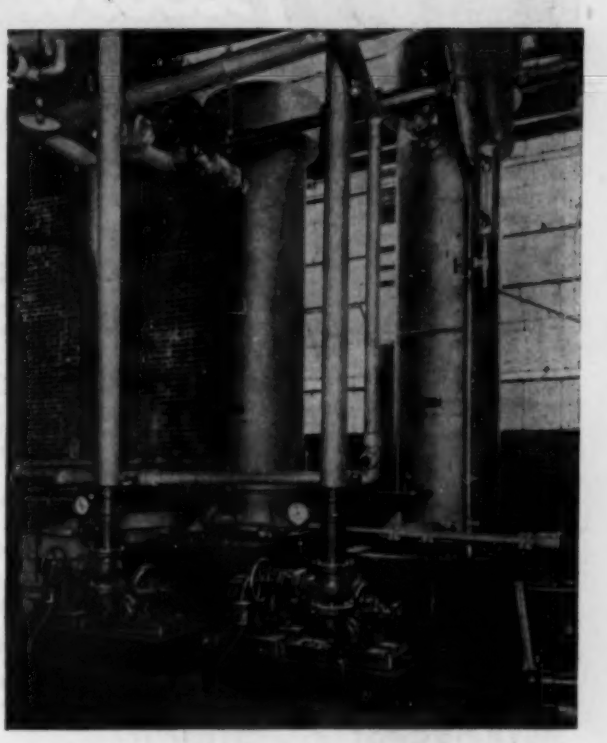

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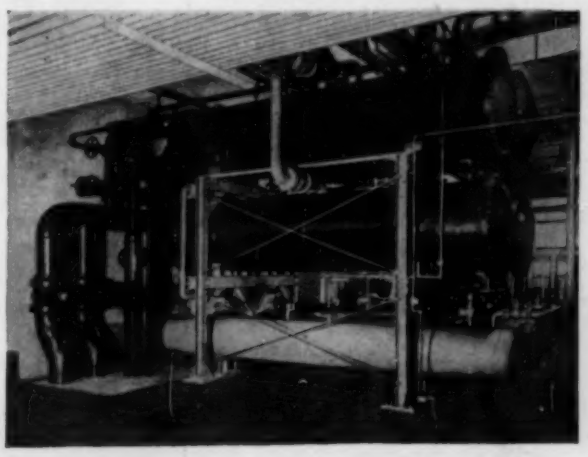

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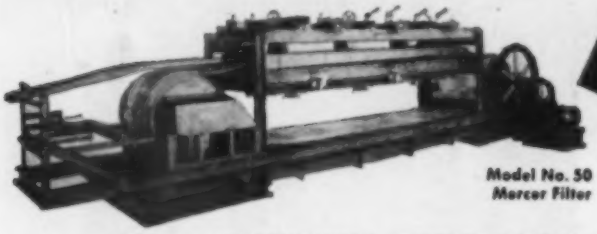

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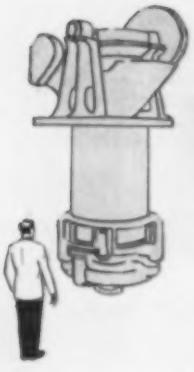

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chemistry. The author has been very successful in reducing an extensive and complex subject to a concise and clear presentation, and deserves a great deal of praise for preparing this excellent book.

Literature Review

THEORY, APPARATUS, AS WELL AS PROCEDURES OF DISTILLATION AND RECTIFICATION. *Edited by H. Stage and G. R. Schultze. Hobart Publishing Co., Washington 15, D. C.* 179 pages. $6.75.

AS A REVIEW of the literature in the field of distillation from 1920 to 1944, this book will provide a very helpful fund of information. Of earlier literature in the field, in general, only the fundamental publications have been reviewed.

Within the body of the text there are six major subdivisions. These cover distillation theory, design of columns, method of operation, and discussion of various distillation problems, both in industry and in the laboratory. Of considerable help in using the book is the author index.

Originally published by VDI-Verlag in Berlin in 1944, the copyright of this original German work was vested by the Alien Property Office. The foreword and table of contents have been translated into English, and the entire book republished by authority of the Attorney General.

The authors' statement in the foreword offers a compelling argument for adding this book to the reference library: "We are making it (the following literature survey) available, conscious of the fact that with it the work of all our technical colleagues, who have anything to do with distillation, will be made easier; the total of over 2,000 newer publications indicates that for every special distillation problem a certain amount of preliminary work has already been done, which may be profitably utilized."

Safety First

EXPLOSION AND COMBUSTION PROCESSES IN GASES. *By Wilhelm Jost; translated by H. O. Croft. McGraw-Hill Book Co., New York.* 621 pages. $7.50.

Reviewed by F. C. Mitchell

THERE has long been need of a book compiling all the data relative to the important subject of explosions and combustions of gases. Here is such a book. Dr. Croft has done a very creditable translation of a magnificent volume covering the entire range of the field of explosive mixtures, ignitions, and flame propagations. What are normally considered very complex

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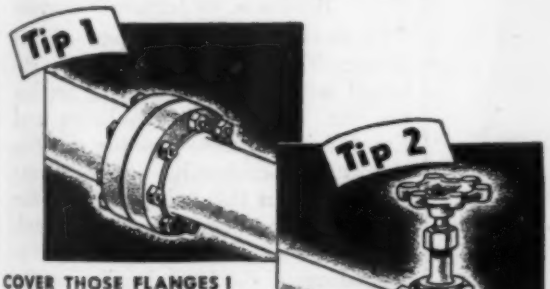

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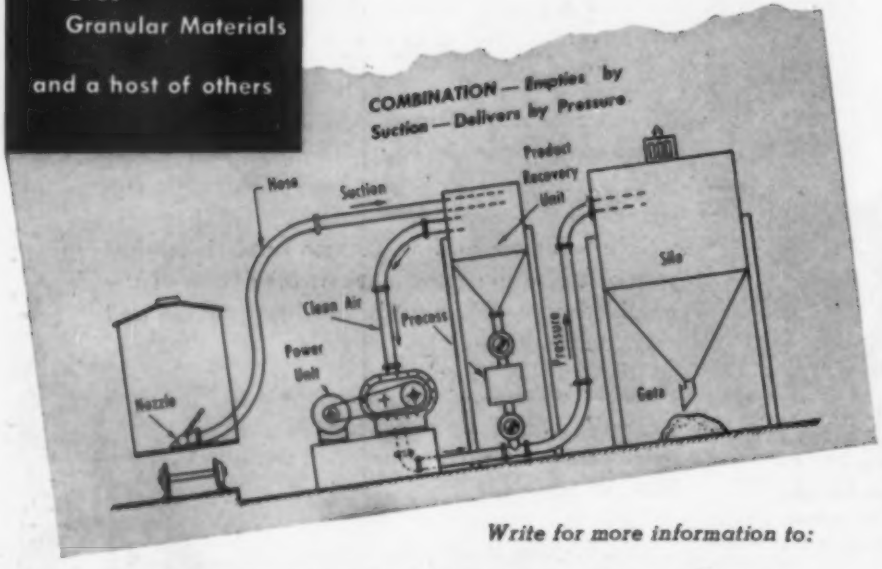

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phenomena Herr Jost has broken down to simple stages. In regular sequence he presents causes (intentional and unintentional), circumstances (physical qualities) to be met before ignition can take place, conditions governing the propagation of flame, kinetics of combustion, unconfined combustion, and explosions or rapid combustions in closed chambers, finishing with an analysis of the combustion characteristics in an Otto engine and in a diesel engine.

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From Britain

EMULSION TECHNOLOGY, THEORETICAL AND APPLIED, INCLUDING THE SYMPOSIUM ON THE TECHNICAL ASPECTS OF EMULSIONS. *Second enlarged edition. Chemical Publishing Co., Brooklyn. 360 pages. $6.50.*

Reviewed by Jerome Alexander

THE PREFACE to the second edition states: "This edition has been enlarged with a comprehensive section on the *Theory of Emulsions* and *Emulsifying Agents*. Another new feature is an up-to-date list of emulsifying agents . . . In this enlarged form, the book embraces every aspect of emulsions and emulsifying agents." Examination of the book hardly justifies this last statement, for apart from the new matter, the book is apparently printed from the unchanged plates of the first edition, which was somewhat stale at the time of its publication in 1943. The Leather Trades Chemists symposium which supplied most of its papers, had been held in 1935, and the latest literature references mentioned are of this date. This brings us to Section 16, the new matter mentioned in the preface.

Apart from the useful 18-p. list of commercial emulsifying agents, Section 16, is mainly a review, by George M. Sutheim, of various theories of

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emulsions and emulsification, going back to W. Marset (1862). It makes no mention of the work of W. Ascherson (1840), considered so important by the British Association for the Advancement of Science that it is the first paper in their book "Foundations of Colloid Chemistry," edited by E. Hatschek. In 1879, Wm. M. Ord, in his important book "The Influence of Colloids on Crystalline Form and Cohesion," mentions that Ascherson found that "when oil and albumen are shaken together, an emulsion is formed which is permanent, because every globule of oil is instantly invested by a pellicle." This clearly antedates those mentioned as exponents of the surface-film theory of emulsions. The effect of adsorbed water films is not adequately considered, though Zsigmondy and others pointed out their importance.

Sutheim quotes ten definitions of "emulsion," including his own, "all of which are rather good, though there is scarcely a point upon which the authors are in full agreement."[1] This is not correct, unless one considers words rather than meaning. This peculiar point of view again appears on p. 288, where it is stated that "by replacing the expression 'degree of dispersion' by 'size of dispersed particles,' the classification into coarse, colloidal and molecular dispersions take on a definite meaning. There is no longer any need to speak in vague, meaningless terms, such as fine, very fine or fairly coarse. Exact, numerical statements can be made." But no mention is made of the modern work of Eyring, Guth, Stanley, Flory, and many others, dealing with size distributions and particles that are far more complicated than uniform simple spheres. In the very next paragraph, after giving numerical limits for "coarse," "colloidal" and "molecular" dispersion, it is stated: "Of course, there will be no sharp line of demarcation between two different types of dispersions. . . . All that can be said is this: within the realm of a certain type of dispersion the properties attributed to that type will prevail. For instance, the properties which are called colloidal will prevail within the colloidal range; they are most accentuated in the center of that range and vanish gradually toward both ends." What has become of "exact, numerical statements"?

All this shows that nature does not adapt herself to words. Definitions should be couched in language sufficiently broad to cover the facts; but for particular cases, if the details are known, less general statements may be made. Zsigmondy pointed out that mercury hydrosols behave like those of other metals rather than like emul-

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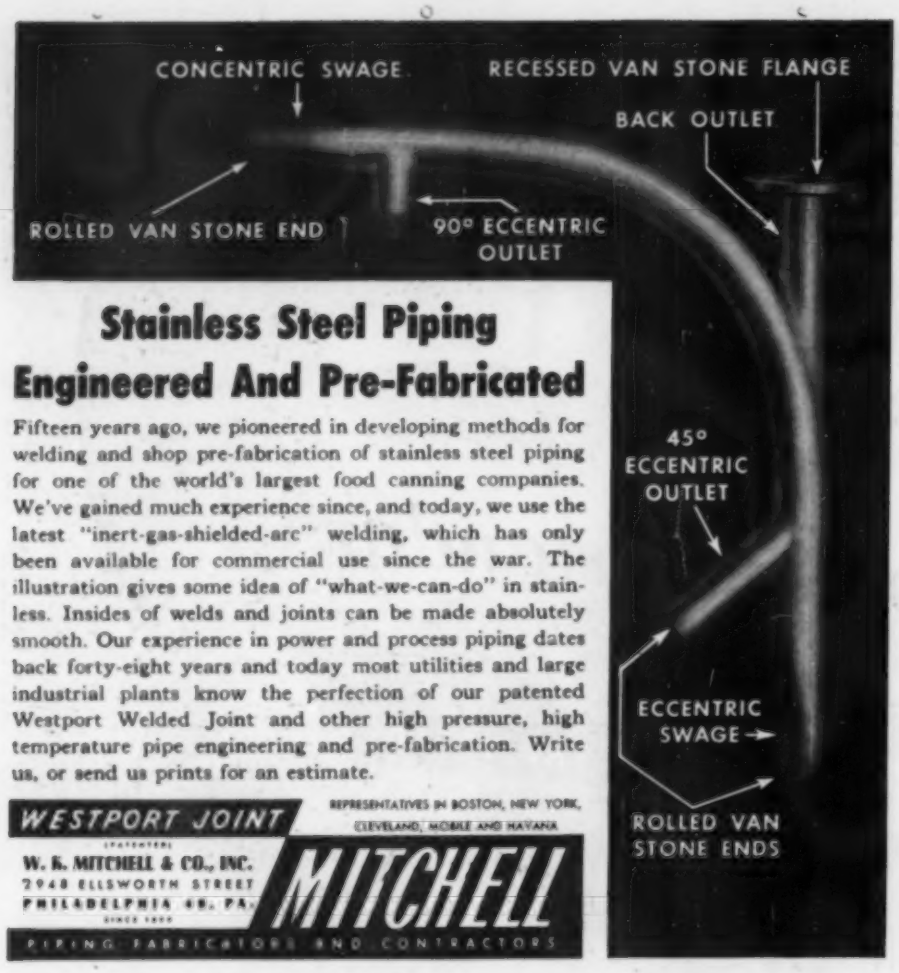

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sions, which raises the important though unconsidered question as to whether very small particles of a liquid may no longer exhibit normal liquid properties. The chemical and physical nature of the dispersed particle must be considered, as well as its "size" or "diameter."

RECENT BOOKS and PAMPHLETS

Heating and Ventilating Buyers' Directory. Edited by Clifford Strock. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. 339 pages. $1. Primarily a product directory, listing the names of manufacturers or sources of supply of equipment, supplies and services. Includes a trade name section.

Manual of Laboratory Safety. Published by the Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa. 34 pages. Gratis. Treats accident prevention, first aid treatment, fire prevention and safety equipment for the laboratory.

Safety Rules for Use in Chemical Works. Third edition, Part I, Model Rules, published by the Association of British Chemical Manufacturers, 166 Piccadilly, London, W. 1, England. 71 pages. A revised set of rules based on British experience and legislation.

Best's Safety Directory, 1948. Published by Alfred M. Best Co., 75 Fulton St., New York 7, N. Y. 494 pages. $5. Second annual edition telling what safety products to use for specific hazards, how to use them and where to get them.

Sulphuric Acid Survey of Pacific Northwest. By Marshall T. Ramstad. Industrial Dept., Chamber of Commerce, Tacoma, Wash. 9 pages. An excellent field survey of the market for sulphuric acid in the Pacific Northwest. Lists producers in the area and its periphery, estimated present market of acid by major users (with tonnages) and present users of liquid SO_3 (with tonnages). Includes a discussion of probable future market for acid and SO_3 in the area.

Phenol Market in Pacific Northwest. By Marshall T. Ramstad. Industrial Dept., Chamber of Commerce, Tacoma, Wash. 8 pages. An excellent field survey of the market for phenol and phenolic resins in the Northwest. Surveys softwood plywood and plastics overlay industries. Gives present producers of phenolic resins in the area, present and estimated future requirements of phenol by the softwood plywood, plastics overlay and oil refining industries. Includes data on hot press capacities and phenol raw material supplies.

Low Pressure Aerosols. By H. E. Peterson. Bulletin No. 14, published by the Continental Can Co., 100 East 42nd St., New York 17, N. Y. 22 pages. Report on four years of the publisher's research on low pressure aerosols.

Inorganic Chemical Nomenclature. By Lloyd McKinley. Published by the University of Wichita, Wichita, Kan. 37 pages. An elementary manual emphasizing rules for naming compounds and writing formulas.

A.S.T.M. Standards on Copper and Copper Alloys. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 462 pages. $4. The 1947 edition of this compilation includes sections on the following products; plate, sheet and strip; wire, rods, bars and shapes; pipe and tubes; alloys for sand castings; alloy die casting.

El Problema de la Corrosion Metalica. By Emilio Jimeno. Published by the Instituto Espanol de Oceanografia, Madrid, Spain. 237 pages. Discussion of the problem of the corrosion of metals and some solutions for it. (In Spanish.)

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Index to A.S.T.M. Standards. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 234 pages. Covers all the current standards in all five parts of the 1946 Book of ASTM Standards as well as the standards published in the 1946 Book of ASTM Methods of Chemical Analysis of Metals.

Symposium on Plasticizers. Published by Interscience Publishers, 215 Fourth Ave., New York 3, N. Y. 96 pages. $1.75. Reprinted from the "Journal of Polymer Science," these five papers were first presented at the University of Buffalo on June 7 and 8, 1946.

Research Publications of the Polytechnic Institute of Brooklyn, Vol. VI. Published by the Polytechnic Institute of Brooklyn, 85 Livingstone St., Brooklyn, N. Y. Arranged in three groups, this collection of articles has been prepared by members of the staff of the Polytechnic Institute of Brooklyn and published during the period from Sept. 1, 1942 to Aug. 31, 1943. Part I ($1) deals with mechanical, aeronautical and electrical engineering. Part II (75c.) with high polymers and physical chemistry and Part III (50c.) with chemical engineering.

Conference on Lead Poisoning. Published by Lead Industries Association, New York 17, N. Y. 54 pages. A reprint of six papers presented at the Seventh Annual Congress on Industrial Health.

Research in Controlled Vacuum Heat Treating. By Jack Huebler. Published by the American Gas Association, 420 Lexington Ave., New York 17, N. Y. 19 pages. Final report of results obtained from a research project conducted for the Committee on Industrial and Commercial Gas Research of the AGA by the Research Laboratory of the Surface Combustion Corp.

Management and Human Relations in Industry. Edited by P. Anderson. Published by Industrial Relations Publishing Corp., 1165 Broadway, New York 1, N. Y. 103 pages. $2. Vol. 1 in The Labor and Industrial Relations Yearbook and Directory for 1947.

Symposium on Testing of Parts and Assemblies. Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. 96 pages. $1.50. Six technical papers by authorities on the correlation of testing and serviceability.

Patents on the Reactions of Sugars. By Alvin Guttag. Technological Report Series No. 1 published by the Sugar Research Foundation, 52 Wall St., New York, N. Y. 108 pages. A digest of patents covering attempts to utilize chemical transformations of the sugars for practical technological purposes.

Report on Standard Samples for Spectrochemical Analysis. Compiled by A.S.T.M. Committee E-2, Subcommittee IV on Standards and Pure Materials. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 28 pages. $1.25. An extension of the 1943 report on available standard samples.

Preparation of Anthracite Silt for Boiler Fuel in a Humphreys Spiral Test Plant. By H. H. Otto, V. H. Wilson, and W. L. Dennen. Bulletin 6 published by The Humphreys Investment Co., First National Bank Bldg., Denver, Colo. 291 pages. Reprinted from Transactions of the Fifth Anthracite Conference of Lehigh University.

Hazard Survey of a High-Voltage Electrostatic Process for Spray-Deposition and Dip-Detearing of Paints. Published by the National Board of Fire Underwriters, 85 John St., New York 7, N. Y. 40 pages. This N.B.F.U. Research Report No. 6 contains an appendix on Resume of Reports Relative to Electrical Shock Hazards.

Symposium on Atmospheric Weathering of Corrosion-Resistant Steels. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 85 pages. $1.50. This symposium, presented at the 1946 A.S.T.M.

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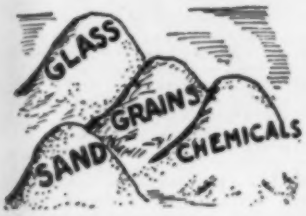

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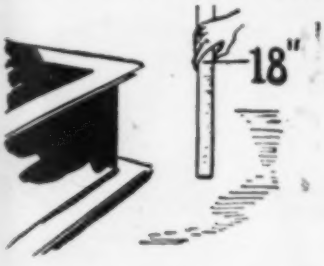

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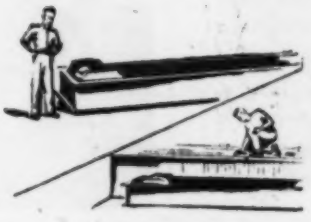

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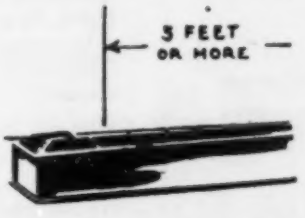

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annual meeting, incorporates information and data developed by leading organizations concerned with the problem.

Consolidated Index of Publications. Bulletin 131. California Division of Mines, San Francisco, Calif. 872 pages. $8.75 plus 2.5 percent sales tax for Californians. An excellent and complete paper-bound index of the various publications issued by this bureau during the 63 year period 1880-1943 inclusive. Material indexed by subject, author, title of report, county, title of mine or claim, mineral or ore, and specific locality. Contains some 75,000 entries.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

World Chemical Developments, 1940-46. Part 1. By C. C. Concannon and A. H. Swift. Department of Commerce, Industrial Series No. 75. Price 30 cents. Review of trends abroad that may have significance for American chemical enterprise. Includes certain foreign trade statistics.

Asphalt Floor Tile. Special feature of Construction and Construction Materials Industry Report, December 1947, Bureau of Foreign and Domestic Commerce. Processed.

American Standard Specification for Dry Cells and Batteries (Leclanché Type). National Bureau of Standards Circular C466. Price 10 cents. Includes standard testing procedures.

Pending Tariff Changes. U. S. Tariff Commission, unnumbered mimeographed document which gives "List of concessions agreed upon at Geneva but which do not go into effect on January 1, 1948." The changes reported are those in trade agreements not yet ratified but expected to become effective shortly.

Explosives or Other Dangerous Articles on Board Vessels. Published by Interstate Commerce Commission. Price $1.50. Revision of July 1, 1947, of regulations governing transportation, storage, stowage, or use of explosives or other dangerous articles or substances, and combustible liquids on board vessels.

Bone Char Revivification and Filtration. By V. R. Deitz. A preliminary survey, 300-page report without number. Obtainable only from National Bureau of Standards, Washington 25, D. C. Price $3, by check payable to Treasurer of the United States.

Douglas Fir Plywood (Seventh Edition). National Bureau of Standards, Commercial Standard CS45-47. Price 10 cents. Includes definitions and inspection and testing methods, but little detail about glues.

Plastics for Plywood. A considerable number of technical reports recently published are now available from Forest Products Laboratory, Madison, Wis. These include discussion of plastic glues and their performance, including durability and strength-testing reports.

Sound Insulation of Wall and Floor Constructions. By V. L. Chrisler. National Bureau of Standards, Report BMS17. Price 20 cents. Supplements 1 and 2 also available, prices 5 cents and 10 cents, respectively. Effective values of

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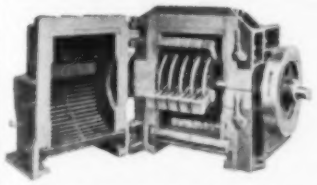

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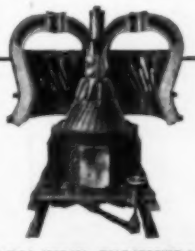

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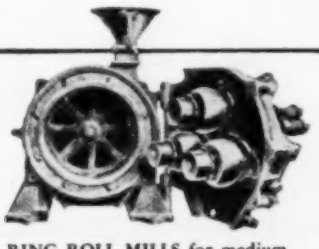

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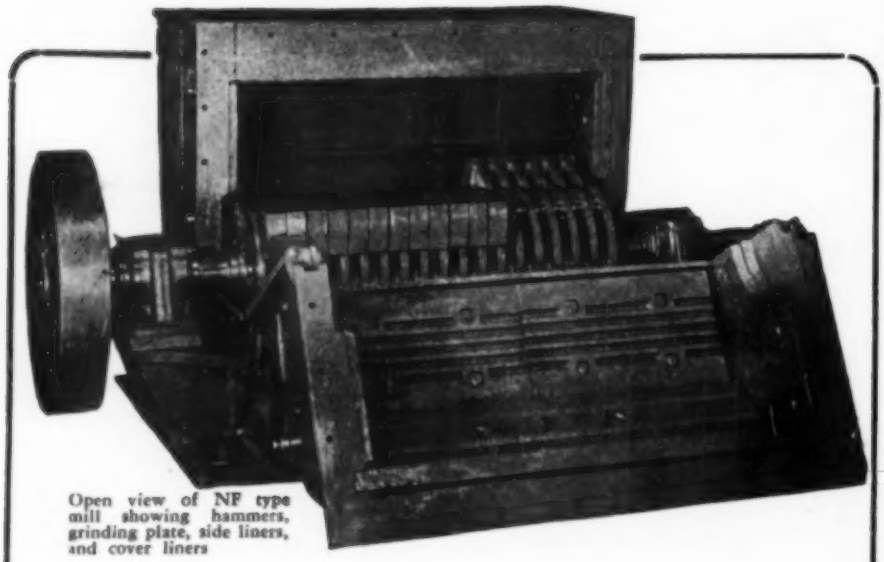

Open view of NF type mill showing hammers, grinding plate, side liners, and cover liners

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various materials and methods of as sembly are summarized.

Accident-Record Manual for Industri Plants. Bureau of Labor Statistics, Bu letin No. 772. Price 10 cents. An outlin of methods of accident recording an use of data in accident prevention.

National Advisory Committee for Aer nautics is publishing many wartim "Technical Reports" for 1941-1944, in clusive. These were restricted durin the war period, but are now availab for purchase. Attention is called to the availability at a subscription price $3 per year, which sum should be se to Superintendent of Documents, Go ernment Printing Office, Washington 2 D. C.

Results of Screening Tests with Mater als Evaluated as Insecticides, Miticide and Repellents at the Orlando, Fl Laboratory, April 1942 to April 194 Bureau of Entomology and Plant Qua antine, E-733. Processed. Elaborate e perimental data summary for hundre of compounds with numerous specif pests.

Preliminary Tests of Synthetic Organ Compounds as Insecticides. Part IV. E G. T. Bottger and Clemence Levin. B reau of Entomology and Plant Quara tine, E-738. Processed. Further deta on both well established and newly pr posed compounds.

Effect on Plants of DDT Applied to S for the Destruction of Japanese Beet Larvae. By Walter E. Fleming. Bure of Entomology and Plant Quarantin E-737. Processed. Effect on plant grow of insecticides in soils critically studie

Carbon Dioxide as a Propellent for I secticide Solutions. By R. A. Fult Bureau of Entomology and Plant Qua antine, E-739. Processed.

The Use of Carbon Dioxide for Control ing Rodents in Cold Storage Room Office of the Secretary, Department Agriculture. December 1947. Mime graphed.

Fats and Oils—Supply and Disposit Specified Periods (Estimated), October 1947-July 1, 1948. Production and Ma keting Administration. Mimeographed.

Bureau of Mines, Mineral Market R ports. Give preliminary estimates production and marketing of ores a minerals during 1947. Separate bri mimeographed reports are being issu currently as first commodity returns a available at the bureau. Individual co modity reports sent on request. general mailing list maintained for items.

Development of a Successful Hard-Su faced Bit for Drilling Oil Shale. Tell Ertl, et al. Bureau of Mines, R port of Investigations R. I. 4177. Mime graphed.

Elimination of Iron in Ammonium Su from Clay. By A. T. Sweet and Douglas Gardner. Bureau of Mines, R port of Investigations R. I. 4183. Mi eographed

Effect of Hydrocarbons and Other Gas Upon the Explosibility of Acetylene. G. W. Jones, et al. Bureau of Min Report of Investigations R. I. 41 Mimeographed.

Electrowinning of Cobalt from Cobalti Concentrates. By F. K. Shelton, et Bureau of Mines, Report of Investi ations R. I. 4172. Mimeographed.

Annual Report of the Tennessee Vall Authority for the Fiscal Year End June 30, 1947. Price $1. Summariz electrochemical activities and some r sults of fertilizer investigations; b mainly an administrative report.

Navy Research Conference. Papers p sented at Washington, D. C., Nov. 18-1 1947. Available only from office of Na Industrial Association, Inc., 110 Willia St., New York 7.

Bureau Reports. Annual reports for t fiscal year 1946-1947 are currently bei released as they are delivered to Co gress. Those interested in summari of technical work should address t individual bureaus believed reporti work of interest. Single copies genera available free.

Procaine Penicillin G Crystalline—Pfizer

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This new Penicillin Salt — a product of Pfizer research — will soon be available to the pharmaceutical industry. Procaine Penicillin G Crystalline — Pfizer will be supplied in bulk as the dry, crystalline, sterile salt, and also as its sterile suspension in oil packaged in 10 cc bottles containing 300,000 units per cc.

Extensive clinical investigations have demonstrated that administration by intramuscular injection of 1 cc of an oil suspension containing 300,000 units of Procaine Penicillin G Crystalline — Pfizer results in therapeutic blood levels for a period greatly in excess of that hitherto obtained with other dosage forms.

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MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Reader's Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 159-160.

(Continued from page 160)

applicable to the new line of Kontrol-Motor diaphragm valves and pressure regulators made by this company.

114. Flooring Material. Walter Maguire & Co. Inc., New York—Bulletin 701 features the application of natural emery as an aggregate for concrete floors.

115. Attrition Mill. The Bauer Bros. Co., Springfield, Ohio—2-page leaflet illustrating and describing the high-speed, central revolving disk attrition mill made by this company.

116. Fire Alarms. The Autocall Co., Shelby, Ohio—A booklet is now available from this company describing this firm's fire-alarm signal equipment.

117. Instruments. The Bristol Co., Waterbury, Conn.—Catalog No. W-1815 contains 24 pages of information in this company's line of industrial instruments.

118. Tube Cleaners. Elliott Co., Roto Division, Newark, N. J.—4-page leaflet describing the tube cleaners made by this company. Various models are illustrated.

119. Solvents. The DuBois Co., Cincinnati, Ohio—Booklet listing various petroleum, aromatic and chlorinated hydrocarbon solvents used in metal cleaning. Physical and chemical properties are tabulated.

120. Paints. American Chemical Paint Co., Ambler, Pa.—4-page pocketsize leaflet giving information on painting metal with this company's products.

121. Fiberglas Plastics. Owens-Corning Fiberglas Corp., Toledo, Ohio—36-page booklet containing information on the properties of Fiberglas, Fiberglas reinforced plastics, their application and other pertinent data.

122. Resinous Adhesives. American Cyanamid Co., New York, N. Y.—12-page booklet describing the resinous adhesives made by this company.

123. Filters. Filtration Engineers, Inc., Newark, N. J.—4-page bulletin No. 102 titled "How the Rotary Vacuum Filter Operates." The principal of operation is illustrated with a cutaway view of the string filter made by this company.

124. Control Valves. O. C. Keckley Co., Chicago, Ill.—4-page catalog No. 48M illustrating and describing the control valves, temperature and pressure regulators and other equipment made by this company.

125. Porcelain Enamel. Ferro Enamel Corp., Cleveland, Ohio—Technical Bulletin No. 7 is entitled "A Study of the Free Silica in Dusts Common to the Porcelain Enamel Industry." Information given is said to be valuable to safety engineers in the ceramics industry in solving plant dust problems.

126. Adhesives. Paisley Products Inc., Chicago, Ill.—Service bulletin describing folding machine pastes for pasting binding of pamphlets, magazines, and similar products.

127. Fans. Westinghouse Electric Corp., Pittsburgh, Pa.—8-page booklet describing the performance of the company's Axiflo fans for high temperature application.

128. Valves. The Appliance Co., Cleveland, Ohio—Catalog No. 301. 52-page

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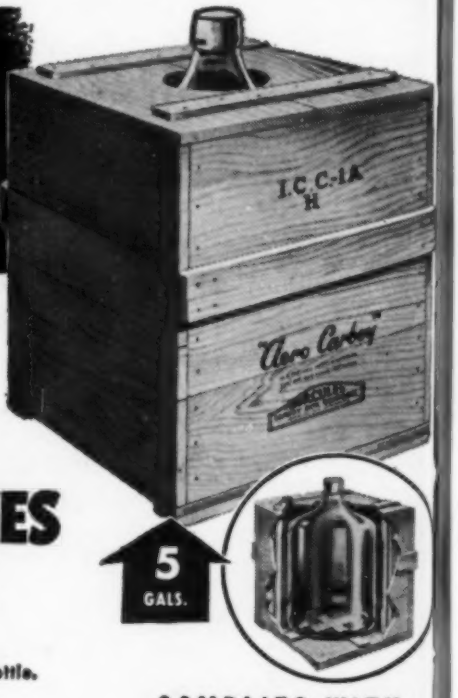

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WEIGHT Approx. 23 lbs. without bottle.
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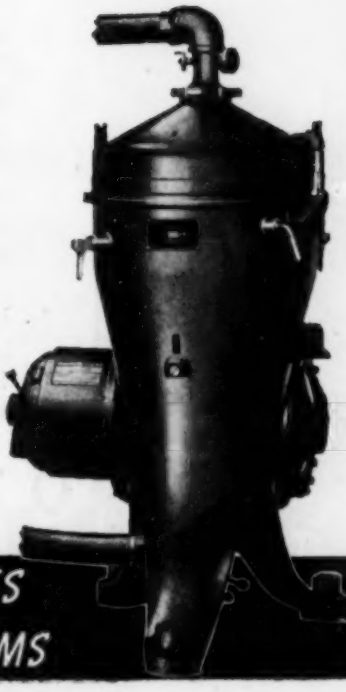
The liquid stored in fire drums aboard Navy vessels during World War II was converted into fire-fighting foam by means of a jet nozzle. The foam is based on a protein solution, and in its manufacture, insoluble matter of a slimy nature is formed. If these slimy materials were allowed to remain in the solution, they would clog the intake screen at the time of use and would prevent proper nozzle performance.

The major manufacturer of this type of fire-fighting foam fluid got rid of these slimy solids by using De Laval Centrifugal Clarifiers. Gravity plus decanting had required 14 days—the centrifugal machine did the job much better continuously.

Here is another illustration of how the right De Laval machine can save time and money by speeding up a process. Sometimes the application is a simple one; in some cases, centrifugal force will break emulsions that are too tight to break by other means. Write for details.



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catalog describing the globe, needle, check, release and plug valves made by this company. Contains specifications and application data.

129. Welding Fittings. Taylor Forge and Pipe Works, Chicago.—6-page pocket-size bulletin No. 476 describing and giving and giving dimensional data for stainless steel welding fittings and flanges made by this company.

130. Proportioning Pumps. Milton Roy Co., Philadelphia, Pa.—2-page leaflet announcing this company's Constametric Pump for controlling flow without pulsation.

131. Stainless Steel Piping. Tube Turns Inc., Louisville, Ky.—New booklet entitled "Stainless Steel Piping—Why and Where to Use It" contains information on reasons for using stainless steel piping, important types of stainless steels, standardization of pipes and fittings, welding fabrication, as well as numerous tables and illustrations.

132. Heat Transfer Equipment. The Griscom-Russell Co., New York.—Bulletin 1602 containing 24 pages illustrating and describing atmospheric and submerged condensing and cooling sections known as G-R Bentube Section.

133. Ion Exchange. Liquid Conditioning Corp., Linden, N. J.—4-page booklet No. 13 describes the Liquonex ion exchange materials available from this company.

134. Materials Handling. Revolvator Co., North Bergen, N. J.—Bulletin 157, 4-page folder illustrating and describing the power Liftruck for use with platform skids.

135. Bearings. Link-Belt Co., Chicago. —16-page illustrated booklet No. 2196 describes the new DE radial-thrust self-contained pre-adjusted roller bearing made by this company.

136. Instruments. Hastings Instruments Co., Inc., Hampton, Va.—4-page leaflet illustrating and describing a meter for measuring air velocity. Principles of operation are described.

137. Instruments. Northern Equipment Co., Erie, Pa.—Bulletin 475 is a case study of boiler water level control in an industrial plant.

138. Infra-red Lamps. North American Electric Lamp Co., St. Louis, Mo.—8-page booklet illustrating and describing the use of infra-red lamps.

139. Sand Filter. Hardinge Co. Inc., York, Pa.—2-page leaflet describing the automatic backwash rapid sand filter made by this company.

140. Welding Fittings. Tube Turns, Inc., Louisville, Ky.—20-page supplement giving specifications for new items in this company's line of fittings. It is a supplement to catalog No. 111 available from this company.

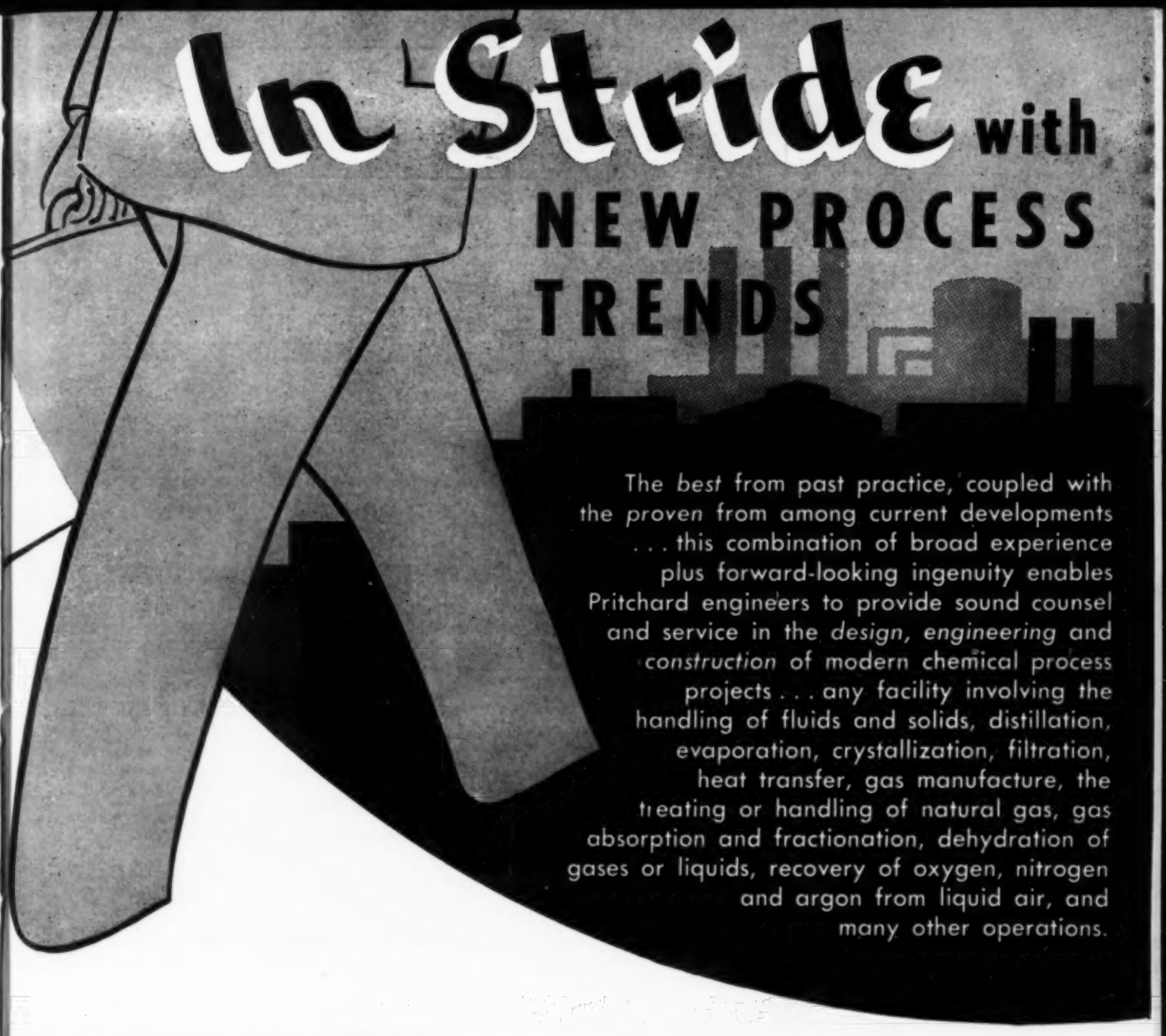
141. Disintegrater. E. D. Jones & Sons Co., Pittsfield, Mass.—Bulletin No. EDJ-1019 contains 6 pages illustrating and describing the Pulp-Master now used in paper mills to disintegrate pulp and paper.

142. Elevators. Allis-Chalmers Mfg. Co., Milwaukee, Wis. — 8-page illustrated booklet describing the Nordyke Service Elevator for use in industrial plants. This is a man-lift type elevator and is designed to qualify under various safety codes.

143. Mercury Vapor Lamp. Westinghouse Electric Corp., Pittsburgh, Pa.—24-page booklet No. A-5112 contains detailed information on electric discharge through vaporized mercury, and includes technical data for 16 types of vapor lamps available from this company.

144. Instruments. American Instrument Co. Inc., Silver Springs, Md.—28-page bulletin No. 2140 describing the complete line of electric hydrometer equipment for both industrial and laboratory applications.

145. Heat Exchangers. Young Radiator Co., Racine, Wis.—1-page leaflet illustrating and describing the cooling and condensing unit manufactured by this company.



The *best* from past practice, coupled with the *proven* from among current developments . . . this combination of broad experience plus forward-looking ingenuity enables Pritchard engineers to provide sound counsel and service in the *design, engineering* and *construction* of modern chemical process projects . . . any facility involving the handling of fluids and solids, distillation, evaporation, crystallization, filtration, heat transfer, gas manufacture, the treating or handling of natural gas, gas absorption and fractionation, dehydration of gases or liquids, recovery of oxygen, nitrogen and argon from liquid air, and many other operations.

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Monobenzyl Ether of Hydroquinone

Dibenzyl Ether of Hydroquinone

Monobenzyl ether of hydroquinone may be used as an antioxidant, stabilizer, or plasticizer in pharmaceuticals, paints, varnishes, and organic synthesis.

Dibenzyl ether of hydroquinone may be used as a high boiling solvent for perfumes, cosmetics, pharmaceuticals, plasticizers, paints, varnishes, and organic synthesis.

Other organic chemicals

Secondary Aromatic Amines

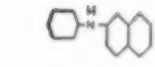
Phenyl B-Naphthylamine

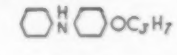
p-Isopropoxy Diphenylamine

p-Hydroxy Diphenylamine

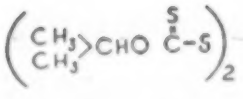
Mixed Mono and Diheptyl Diphenylamines

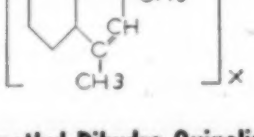
Di-secondary Aromatic Amines

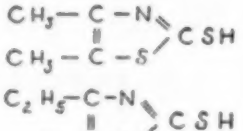

Diphenyl p-Phenylenediamine


Di B-Naphthyl p-Phenylenediamine

Miscellaneous


Di-Isopropyl Dixanthogen


Trimethyl Dihydro Quinoline Polymer


Mixed Ethyl and Dimethyl Mercaptothiazoles

N-Nitroso Diphenylamine

All materials listed here are available in commercial quantities. Prices and technical information are available on request. Please write Dept. CD-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

CHEMICAL CONSUMPTION CONTINUES AT HIGH LEVELS IN SPITE OF RETARDING INFLUENCES

OBJECTIVES that were made public by several industries that are large consumers of chemicals have not been fully met. Fuel shortages in the northern section of the country forced curtailment of production activities and in the case of some industries caused temporary shut downs. The glass industry was one of those that felt the pinch, with at least one large plant forced to close.

Frozen rivers hampered coal deliveries in the Pittsburgh area early in February. Coke oven operators had to dig deeply into their coal stocks and were forced to cut back operations. Together with the shortage of fuel oil which caused an unusual consumption of coal tar as fuel, this led to a drop in output of coal chemicals. Natural gas shortages also forced several steel furnaces to close.

Activities in textiles and paper were not seriously affected. In spite of these stumbling blocks, consumption of chemicals continues at high levels.

Inorganic Output Up

Final figures on annual production of inorganic chemicals showed the results of plant expansion in several chemical fields. Data for two plants not previously reported are included in December's nitric acid output, but even without these plants it hit a record high. Other chemicals that made new production records in December were ammonium nitrate, chlorine, hydrochloric acid, hydrogen, and sulphuric acid. Chemicals that came close to setting new records were synthetic ammonium sulphate, phosphoric acid, sodium chromate and bichromate, electrolytic caustic, soda ash, and salt cake.

Chemical Engineering's index of industrial consumption of chemicals rose in December to 224.19 with fertilizers, and petroleum refining contributing to most of the increase. December fertilizer index is affected by the inclusion of production at four new superphosphate plants. However, even without these units, chemical consumption in fertilizers hit a record high. Consumption in petroleum refining climbed upward in February after dropping below the level reached late in December, as refiners moved to combat the fuel shortage. Paper demand is still high. However, according to some sources in the paper industry, consumers are endeavoring to build up inventories as a hedge against a rise in prices that might result from a third round of wage increases. Textile consumption of chemicals is running below the record breaking levels of the 1947 crop year, but current rates will probably carry through the rest of the 1948 crop year ending July 31. Cotton consumption in January was 860,202 bales. This was more than 100,000 bales over the previous month.

Chemical Engineering Index
Industrial Consumption of Chemicals
1935= 100

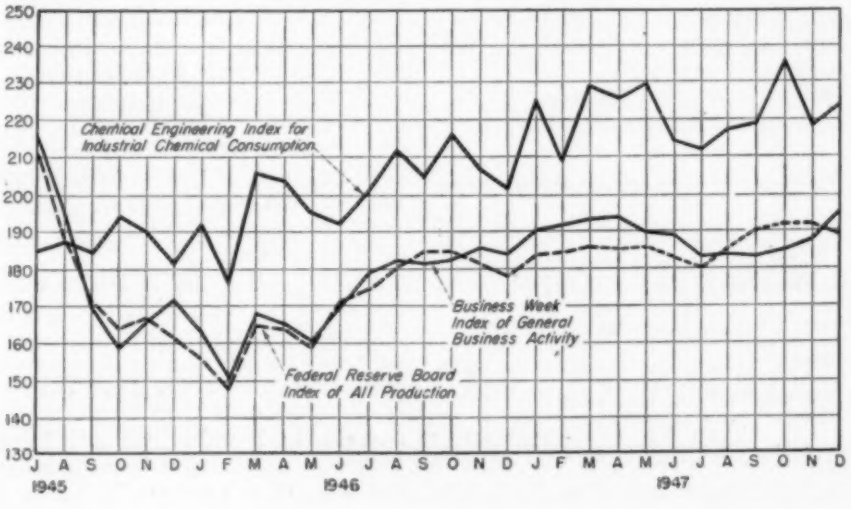
	Nov. (Revised)	Dec.
Fertilizer	52.49	57.79
Pulp and paper	22.90	22.15
Petroleum refining	20.26	21.60
Glass	19.45	19.05
Paint and varnish	19.66	19.01
Iron and steel	13.28	13.51
Rayon	23.56	23.40
Textiles	10.80	10.78
Coal products	10.74	11.10
Leather	5.00	5.02
Explosives	7.66	7.58
Rubber	5.40	5.40
Plastics	7.77	7.80
	218.97	224.19

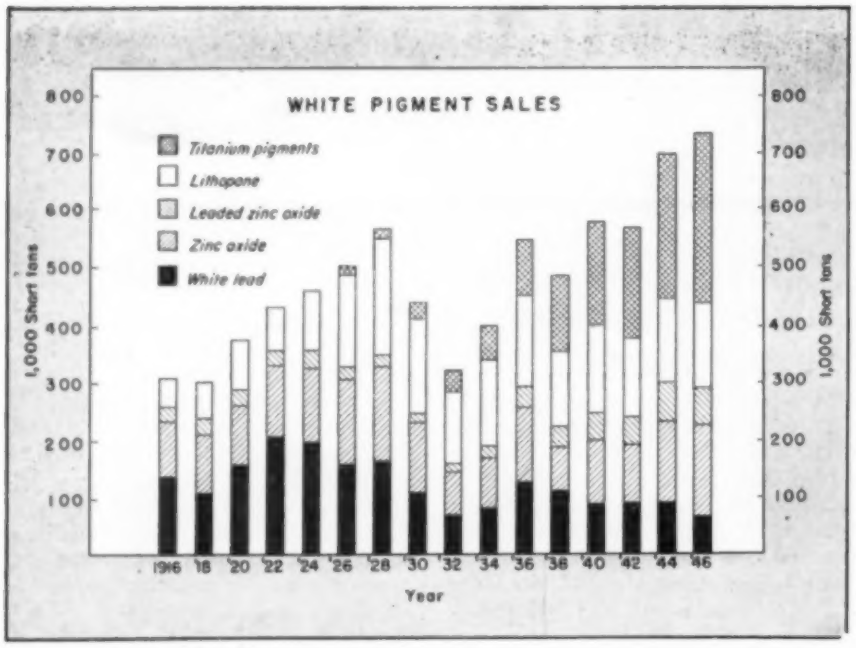
February saw the first real postwar break in oil and fat prices. This break was basically a good thing. Several commodities had held at prices that were caused by the extreme shortages that existed at the close of the war. By mid-February they had reached a more normal level. The downward movement was slacking off.

More Alcohol Coming

Alcohol supply should be eased somewhat with the coming addition to synthetic alcohol capacity. Three producers will swell the country's output. Acetic acid producers are looking at the price of this raw material with considerable interest in view of the high price of blackstrap.

Supply of plastics raw materials has not been as acute as expected. Raw materials are still scarce, but most domestic consumers are able to satisfy their needs. Several soon will complete their expansion plans which include facilities for production of the raw materials. This is in line with a general trend that developed after the war when production of many items was held back by lack of raw materials. Some plastics producers felt that they should be basic in their raw materials to hold a good position in a competitive market.





KING OF THE WHITE PIGMENTS In only 20 years, titanium pigments have pushed head and shoulders over old line whites, now outsell nearest competitor two-to-one

Titanium Pigments

Greatest of the Pigments Are the Whites, And the Greatest of These Are Titanium's

COMMODITY SURVEY

PIGMENTS are measured in the industry by a simple yardstick. This ultimate measure of value is the hiding power per dollar. Titanium dioxide gives the best results when measured by this rule. As a result, it is in very great demand in the paint industry. Titanium pigments make white exterior paints really white. Although titanium is new in the pigment game it has grown rapidly, and is now the largest tonnage white pigment. In spite of its growth demand is far above supply.

Supply is short because present capacities of the producers can't meet the pent up demand. Producers didn't have a chance to grow during the war, and now extremely large demands for paint, ceramics, rubber, textiles, paper, and leather have created an extreme shortage of this raw material. Producers are expanding their plants and new capacities will be in operation this year.

No official production figures have been published for the titanium pigments, because this data might reveal output of individual companies. However, estimates based on the reported TiO_2 content of ilmenite used in production of pigments have been made. From these estimates it can be seen that titanium pigment production grew from a very small amount in 1930 to about 300,000 tons in 1946 and rose even higher in 1947. This is about 40 percent of total white pigment production.

Recently producers have been worried about the uncertainty of imports of ilmenite from overseas and they have moved to develop their own domestic deposits. Du Pont has recently purchased two deposits of ilmenite in Florida. National Lead is operating the largest ilmenite mine in the world at Tahawus, N. Y.

Cyanamid uses ilmenite ore found in local deposits at Piney River and consumes ore from India at Gloucester City. Glidden gets ore from its deposit at Finley, N. C. However, while 404,000 tons of ilmenite were consumed in 1946, only 282,000 tons were produced in the United States. This shows how much the producers depend on imports of ore to operate at present capacities.

Titanium dioxide wasn't originally supplied in pure form as a pigment. To compromise with purification problems, the original pigment was made up of barium sulphate (75 percent) and titanium dioxide (25 percent). Later another composite pigment was produced. This contains calcium sulphate (70 percent) and titanium dioxide (30 percent). However process refinements finally produced a pure titanium dioxide. Use of the 75-25 type composite is gradually falling off, and the calcium-base pigment is the major composite used today. According to some authorities, Du Pont is the big factor in production of pure TiO_2 while National Lead leads in the production of composite titanium pigments.

Most modern paints use several pigments in combination to get optimum results. A typical exterior white paint may contain: titanium dioxide, 15 percent; zinc oxide, 25 percent; white lead, 50 percent; and extender 10 percent. Of course formulations may vary to fit conditions under which the paint will be used.

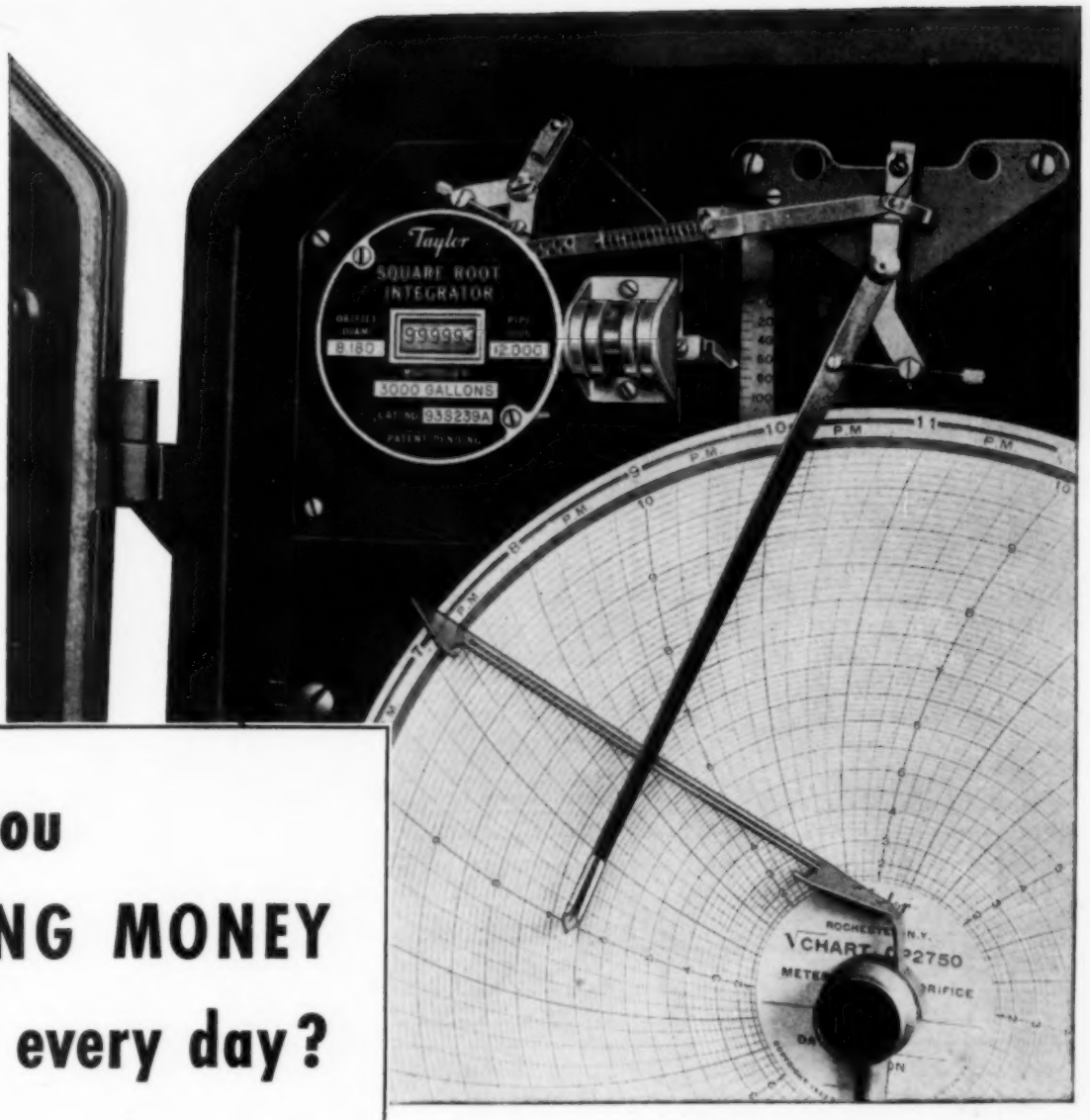
Price-wise titanium dioxide is just about as expensive today as it was in 1930. However in between these dates prices have been considerably lower. A pound of this material cost 17-18 c. in 1932, this dropped to 14½ c. in 1942 and then rose to its current level of 17½ c. Calcium-base titanium pigment followed the same general pattern. In 1932 a pound cost 6-7 c. In 1942 it was down to 5½ c. The current price is 6¾ c. Demand for these pigments will probably continue to run considerably ahead of supply in the coming year as all of the various end uses are in a period of expanding demand.

Estimated Consumption of TiO_2 Pigments

Industry	Percent
Paint, varnish and lacquer	75
Paper	10
Rubber	2
Floor coverings	2
Leather	2
Textiles	1.5
Welding rod coating	1.5
Other	6
Total	100

Titanium Dioxide Producers

Company	Plant Location
American Cyanamid Co., Calco Chemical Division	Piney River, Va. Gloucester City, N.J.
E. I. du Pont de Nemours & Co., Krebs Paint and Pigments Division	Baltimore, Md. Edgemoor, Del.
Glidden Co., Chemical and Pigment Co. Division	Baltimore, Md.
National Lead Co., Titanium Division	Sayreville, N. J. St. Louis, Mo.



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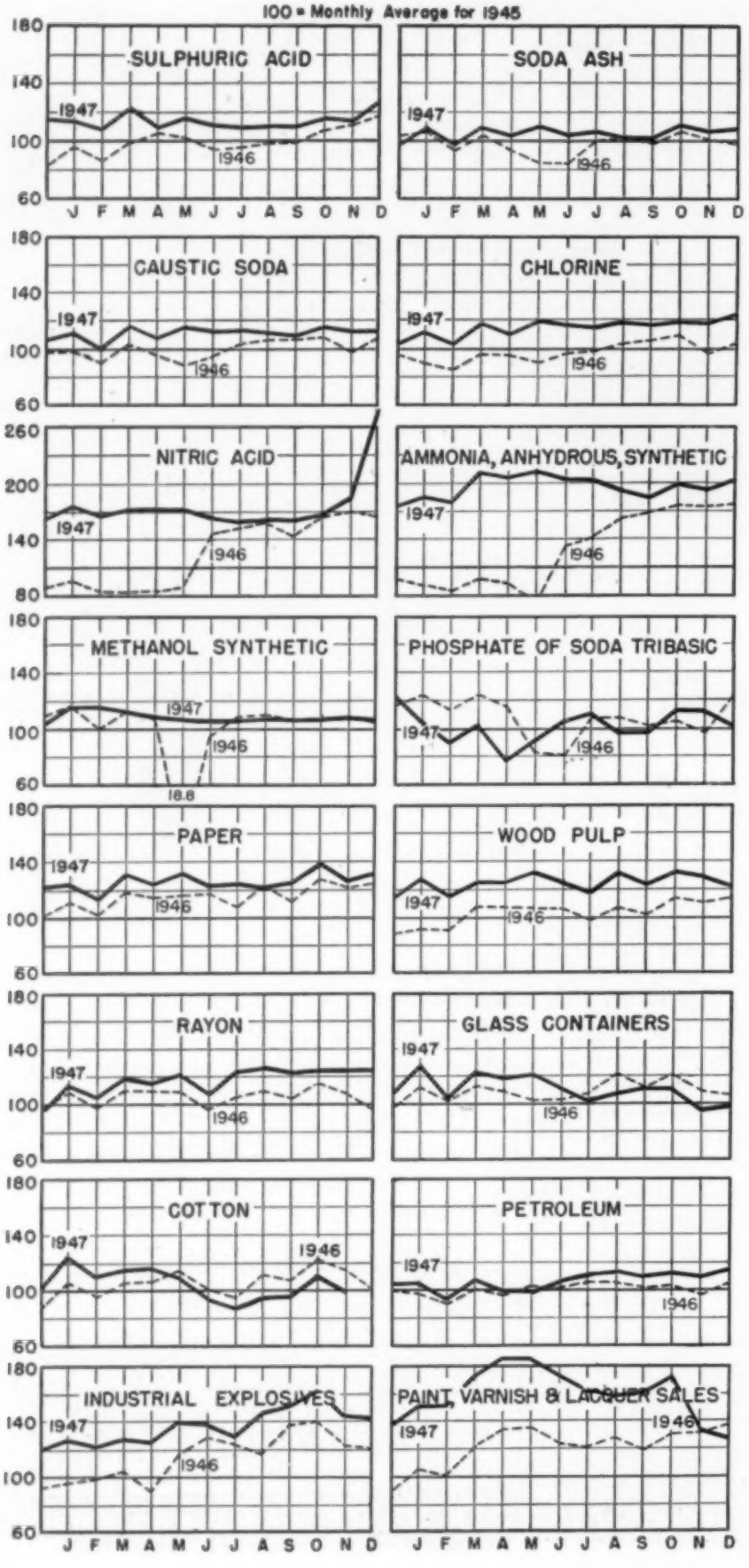
PRODUCTION AND CONSUMPTION TRENDS



PRODUCTION in the chemical indu try got off to a slow start th year. Extremely cold weather aggr vated the seasonal lull. But produc tion has recovered, and in Februar was running close to late 1947 level

Paint, varnish and lacquer sales h a new high in 1947. According to th National Paint, Varnish and Lacqu Association, last year's record breakin dollar volume indicated an increase i actual unit sales.

Rayon production fell off in N vember and again in December aft reaching 88.6 million pounds in Oct ber. However, consumption rose t 84.3 million pounds in Decembe This was 2.2 million above the No vember figure.

Glass containers slumped in D cember with production down abou 5 percent from November. This is normal seasonal fluctuation, neverth less shipments for 1947 were about percent below 1946. Paper produc tion rates for 1947 ran about 3 percen above 1946.

Petroleum run to stills moved up ward in December and in the firs quarter of this year may be 7 percen higher than the corresponding quarte of last year.

Continued high demand for fe tilizers keeps ammonia and nitric aci production at levels reached in 194 Caustic soda manufacturers are sti hard pressed to supply the needs the consuming industries.

Price Trends

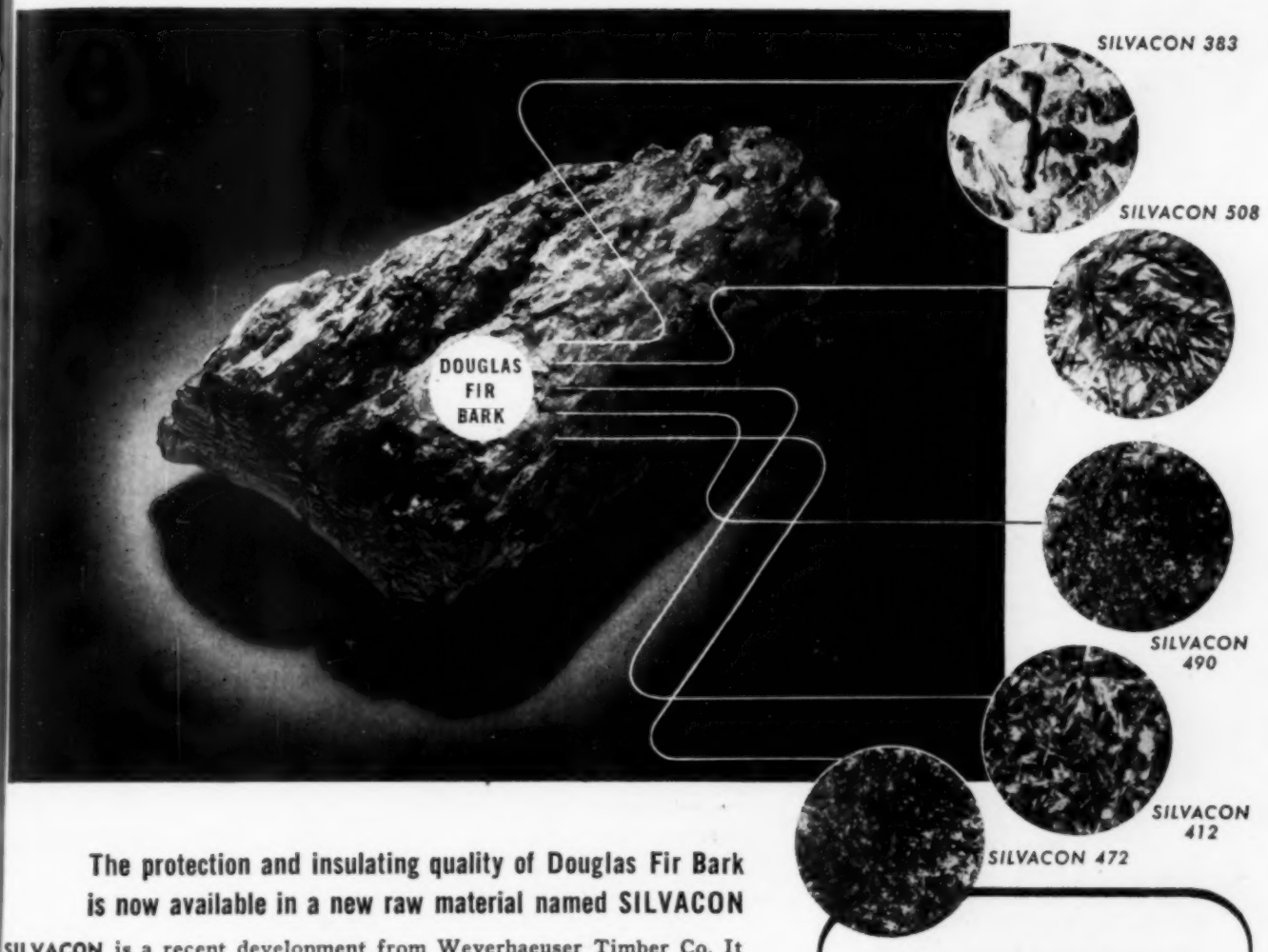
THIS MONTH *Chemical Engineerin* has discontinued its listing of price current. In the future, indexes prices for chemicals and fats and oi will be published monthly. Informa tion on prices of specific chemica will be furnished on request. Sen inquiries to the Market Editor.

Price trend in February was mixed Among the items that registered gain were butane, propane, aniline, an polystyrene. Some fats, oils, and me cury dropped in price.

CHEMICAL ENGINEERING

Weighted Indexes of Prices
Base = 100 for 1937

	Chemical	Oils & Fats
As of March 1..	128.80	282.27
Last Month	127.56	291.41
March 1947.....	123.15	340.10
March 1946	109.13	145.80



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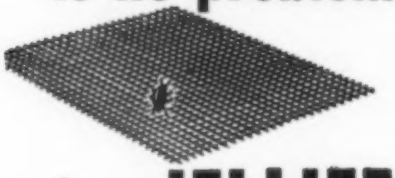

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United States Production of Certain Chemicals

December 1947, December 1946 and Twelve-Month Totals for 1947 and 1946

Chemical (Tons unless otherwise noted)	December 1947	December 1946	Total, Twelve Months 1947	1946
Ammonia, synthetic, anhydrous[1]	92,779	82,123	1,083,745	728,8
Ammonium nitrate, 100 percent	93,340	83,766	1,047,792	724,9
Ammonium sulphate, synthetic, technical (M lb.)	37,546	30,599	393,531	313,3
Calcium arsenate (M lb.)	37,546	754	82,312	25,3
Calcium carbide, commercial	55,343	51,830	608,347	570,1
Calcium phosphate:				
Monobasic (M lb.)	6,282	6,887	71,734	74,9
Dibasic (M lb.)	7,982	7,807	77,627	73,3
Carbon dioxide:				
Liquid and gas (M lb.)	16,746	16,022	243,479	217,2
Solid (M lb.)	41,250	40,765	723,188	644,0
Chlorine	122,682	102,628	1,380,723	1,165,1
Chrome green, C.P. (M lb.)	989	1,160	13,150	17,9
Chrome yellow and orange (C. P.) (M lb.)	4,077	3,117	48,835	43,1
Hydrochloric acid, 100 percent	38,006	30,714	424,329	341,5
Hydrogen (M cu. ft.)	2,279,000	1,582,000	21,953,000	17,605,0
Lead arsenate, acid and basic (M lb.)	.....	3,726	.....	56,6
Molybdate chrome orange (C.P.) (M lb.)	485	407	4,456	4,8
Nitric acid, 100 percent	104,096	62,460	706,765	573,8
Oxygen (M cu. ft.)	1,251,000	1,028,000	13,793,000	10,868,0
Phosphoric acid, 50 percent	90,463	79,788	1,039,612	804,6
Soda ash:				
Ammonia soda process:				
Total wet and dry[2]	389,656	385,360	4,519,144	4,284,2
Finished light[3]	191,022	186,671	2,194,395	2,079,9
Finished dense	140,391	141,030	1,641,352	1,546,7
Natural[4]	24,492	19,631	281,945	209,4
Sodium bicarbonate, refined	14,684	15,999	191,145	188,9
Sodium bichromate and chromate	7,983	6,665	87,574	85,4
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	116,508	100,197	1,338,051	1,120,9
Solid	25,797	14,955	248,683	192,9
Lime soda process:				
Liquid[5]	59,760	64,989	747,769	742,9
Solid	20,794	20,805	244,992	226,3
Sodium phosphate:				
Monobasic	1,221	1,135	14,214	11,9
Dibasic	6,740	5,397	78,859	59,3
Tribasic	7,496	9,057	89,055	94,9
Meta	2,153	2,161	30,652	26,0
Tetra	5,408	3,121	56,169	52,1
Sodium silicate, anhydrous	39,698	32,479	474,599	412,3
Sodium sulphate:				
Anhydrous, refined	11,800	11,753	135,994	122,8
Glauber's salt[4]	17,042	14,789	198,519	167,1
Salt cake, crude, commercial[4]	56,804	50,089	627,528	527,7
Sulphuric acid:[7]				
Chamber process	291,752	283,558	3,284,280	3,119,1
Contact process, new	613,165	551,381	6,654,116	5,646,5
Zinc yellow (zinc chromate) (C.P.)	324	420	3,276	.....

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finish light and finished dense. [3]Not including quantities converted to finish dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Certain Organic Chemicals

November 1947, November 1946 and Eleven-Month Totals for 1947 and 1946

	November 1947	November 1946	Total, Eleven Months 1947	1946
Acetanilid	593,590	927,838	7,059,658	.....
Acetic acid:				
Synthetic[1]	28,027,807	25,446,232	331,009,078	255,528,2
Recovered	133,448,552	106,113,609	1,320,347,596	1,079,624,7
Natural[2]	2,410,845	2,272,164	23,796,809	25,637,5
Acetic anhydride[3]	55,346,923	45,032,579	563,261,710	473,276,2
Acetone	34,465,530	31,401,942	360,879,140	301,963,1
Acetylsalicylic acid	1,015,677	1,009,890	11,346,077	8,887,4

(*Continued on page* 338)

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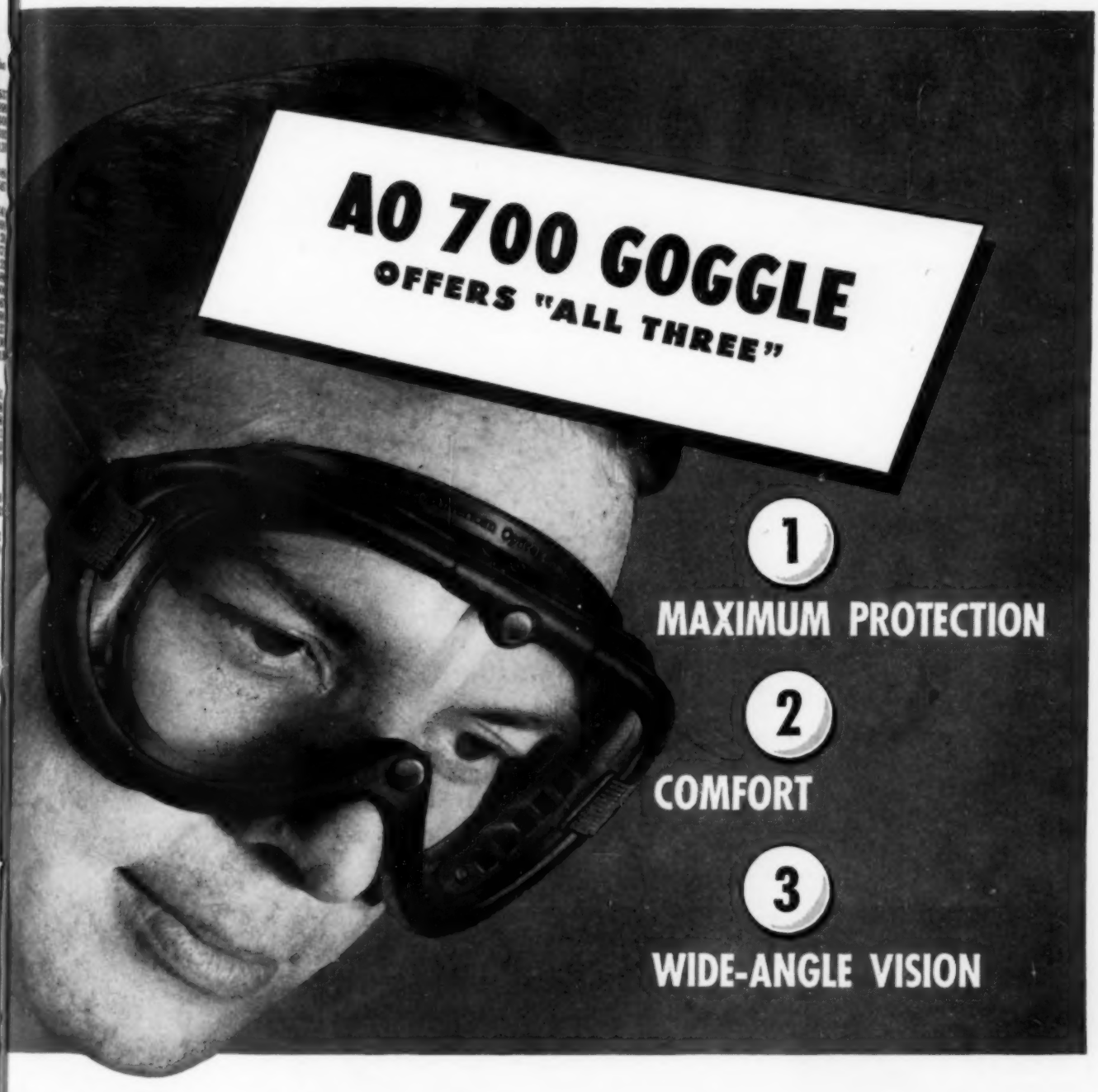

This relatively new, all-rubber frame goggle has already proved its worth in protecting against chemical splashes and sprays, fine dusts and the impact of flying particles. Frame conforms to face contours — airtight fit prevents any seepage of acid or dust. All face-contacting surfaces, including the bridge, are cushioned for comfort, and goggle weight is spread evenly. Fogging is controlled by perforations which allow ample ventilation. Easily replaceable filter element keeps incoming air indirect and dust and acid from eyes. Shatter-resistant, single, large acetate lens provides unusual "seeing" area, reduces dangers from obstructed side vision. Lenses may be quickly, easily replaced.

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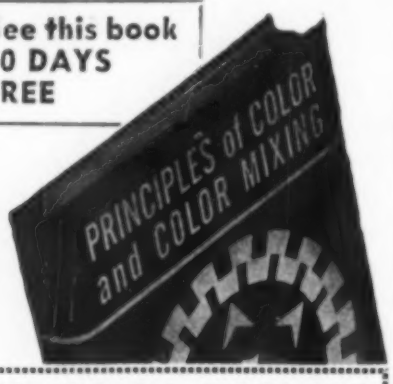

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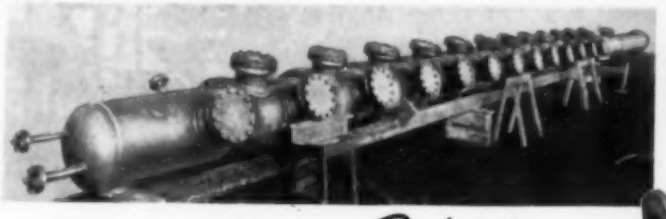
U. S. Production of Certain Organic Chemicals (Cont. from page 336)

	November 1947	November 1946	Total, Eleven Months 1947	Total, Eleven Months 1946
Aniline	9,279,801	8,119,934	98,208,650	81,317,29
5-Ethyl-5 phenylbarbituric acid and salts (phenobarbital)	42,569	29,130	436,777	350,69
Benzene:				
Motor grade:				
Tar distillers[4]	.....	616,312	.....	8,403,98
Coke-oven operator[4]	1,030,437	2,176,261	14,914,138	28,232,12
All other grades:				
Tar distillers[4]	1,718,917	1,367,983	19,637,705	18,628,34
Coke-oven operator[4]	12,396,706	11,821,145	129,338,717	98,047,04
Butyl alcohol primary normal	10,819,771	12,705,974	128,824,021	111,954,94
Carbon bisulphide	30,733,977	25,693,583	321,280,166	273,675,48
Carbon tetrachloride	18,057,688	11,798,312	181,195,595	134,159,28
Chlorobenzene, mono	27,296,600	23,185,277	297,462,867	244,189,05
Creosote oil:				
Tar distillers[4]	9,340,291	9,484,579	111,236,630	101,603,96
Coke oven operators[5]	3,233,168	3,542,876	36,040,578	26,693,58
Creosols, meta-para	659,266	308,386	5,827,399	5,162,36
Cresols, ortho-meta-para	462,523	627,118	8,095,751	.....
Cresylic acid, refined[7,10]	2,056,225	2,100,412	23,852,390	21,649,60
Dibutyl phthlate	2,489,110	1,643,933	19,915,733	.....
Dichlorodiphenyltrichloroethane (DDT)	2,562,496	3,582,138	44,857,479	40,673,14
Ethyl acetate (85 percent)	7,131,943	10,170,182	76,888,148	86,163,17
Ethylene glycol	22,103,140	.....	201,725,708	.....
Ethyl ether	3,368,346	3,113,396	37,581,345	36,485,60
Formaldehyde (37 percent by wt.)	42,085,620	41,470,060	472,412,314	420,623,77
Hexachlorocyclohexane	1,187,583	.....	6,203,821	.....
Methanol, natural[8]	1,520,069	1,329,262	15,117,806	14,511,20
Methanol, synthetic	45,367,780	44,316,435	493,708,232	448,439,69
Naphthalene:				
Tar distillers, less than 79° C.	16,117,925	13,929,474	203,559,783	167,371,41
Tar distillers, 79° C. and over	7,151,364	8,105,767	89,047,958	88,241,70
Coke-oven operators, less than 79° C.	7,965,334	7,891,531	86,740,733	65,149,16
Penicillin and salts[9]	4,870,062	2,721,866	35,509,659	25,453,78
Phenol	23,825,404	18,307,208	243,315,855	179,540,65
Phthalic anhydride	12,373,035	11,245,645	128,088,626	98,359,40
Streptomycin	1,324,616	.....	.....	.....
Styrene, government and private plants	29,168,453	29,321,428	280,430,596	339,899,27
Toluene:				
Coke oven operators	2,410,181	1,733,010	24,651,995	15,172,53
All other	4,683,474	1,547,140	33,853,244	14,368,25
Xylene, crude	2,271,495	.....	36,391,254	.....

All data in pounds except benzene (gal.) creosote oil (gal.) toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [2]Excludes the statistics on recovered acid. [3]Acid produced by direct process from wood and from calcium acetate. [4]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [6]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

NON-FERROUS WELDS TO EXACTING SPECIFICATIONS



WHITLOCK *Heliarc*

WHITLOCK-HELIARC welding technique makes every non-ferrous weld a sound weld. The 43 ft. HCl stripping column of Everdur shown above—a typical product of WHITLOCK-HELIARC welding technique—was fabricated in 12 sections, all welds meeting rigorous code requirements.

The WHITLOCK-HELIARC method has outstanding advantages which assure unusually high quality welds in non-ferrous materials:

- Whitlock is qualified for welding deoxidized copper under Case No. 934 of A.S.M.E. Code for Unfired Pressure Vessels.
- Welds are suitable for X-ray examination, of quality equivalent to A.S.M.E. Code, Paragraph U-68 standards.
- High ductile and tensile strength: Whitlock copper welds show by test 35.2% elongation, 30,500 p.s.i. tensile strength across the weld, and free bend elongations in excess of 30%.
- Deep penetration: Whitlock copper welds have been made in plates up to ¾" thick in aluminum up to 1¾" and in Everdur up to a 2½" thick full penetration flange-shell joint.

Let us quote on your non-ferrous heat exchangers and pressure vessels.

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Bends • Coils • Condensers • Heat Exchangers • Heaters
Piping • Pressure • Vessels • Receivers • Reboilers

AHEAD OF THE TIMES FOR HALF A CENTURY

ROTO-CLONE

removes the double danger of fibrous, greasy dust

View showing three of 14 Type N Roto-Clones collecting buffing dust in this modern plant.

DUST presented a double danger in the polishing department of Mouldings, Inc., Indianapolis, Ind., producers of stainless steel moulding for the automotive field. Buffing metal moulding strip produces a fibrous, greasy dust which is both a fire and health hazard. Here, as in scores of plants, Type N Roto-Clones solve the problem by wet collection of the material.

The Type N Roto-Clone* Hydro-Static Precipitator combines centrifugal forces and intimate intermixing of water and dust-laden air for extremely high cleaning efficiency. It is compact in design, has no moving parts to foul, requires little maintenance and the once dangerous dust is easily removed in harmless sludge form.

The Type N Roto-Clone is available for servicing individual stands, as illustrated, or for use with central system exhausting a group of dust sources. For complete information write for copy of Bulletin No. 277 or contact your local AAF representative.

AMERICAN AIR FILTER CO., INC.
326 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

*Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

AAF

®ROTO-CLONE
DUST CONTROL EQUIPMENT

NEW CONSTRUCTION

Proposed Work

Ala., Childersburg—Coosa River Development Co., c/o J. E. Sirrine & Co., Eng., Greenville, S. C., plans to construct a newsprint mill here. Estimated cost $30,000,000.

Kan., Dodge City—Stanolind Oil & Gas Co., Stanolind Bldg., Tulsa, Okla., plans to construct a synthol plant for the conversion of natural gas to liquid fuels and chemicals. Estimated cost $80,000,000.

La., Baton Rouge—Gulf Refining Co., Gulf Bldg., Houston, Tex., plans to contsruct a gas conservation project here. Estimated cost $4,000,000.

O., Mayfield Heights—Diamond Alkali Co., Painesville, O., and Pittsburgh, Pa., plans to construct a research and administration center on Mayfield Rd. Cutting & Ciresi, 4900 Euclid Ave., Cleveland, Archts. Estimated cost $2,500,000.

O., Toledo—Sun Oil Co., 1608 Walnut St., Philadelphia, Pa., plans to construct an oil separation plant at refinery here to prevent seepage of oil into Otter Creek and Maumee Bay. Estimated cost $600,000.

O., Waterville—Glass Fibers, Inc., River Rd., Waterville, O., plans to construct an addition to its factory here. Continental Industrial Engineering Co., 176 West Adams St., Chicago, Ill., Eng. Estimated cost $500,000.

Okla., Holdenville—Otha H. Grimes & Associates, Kennedy Bldg., Tulsa, plan to construct a gasoline plant here. Estimated cost of initial unit $1,350,000.

Pa., Philadelphia—Girard Paper & Stock Co., 6th and Willow Sts., plans to construct additions to its plant. Estimated cost $100,000.

Tex., Hansford—Phillips Petroleum Co., Bartlesville, Okla., plans to construct a gasoline extraction plant here. Estimated cost $1,000,000.

Washington—Empire Chemical Corp., Butte, Mont., plans to construct two phosphate fertilizer plants—one near Spokane, Wash. and other near Yakima, Wash. Estimated cost $75,000, each.

Contracts Awarded

Calif., Berkeley—Pacific Paint & Varnish Co., 4th and Cedar Sts., has awarded the contract for a 3 story addition to its paint factory to Barrett & Hilp, 918 Harrison St., San Francisco. Estimated cost $400,000.

Calif., Sacramento—Newsom Kraft Corp., 85 Stanyan St., San Francisco, has awarded the contract for the design and construction of a pulp and paper mill on a 560 acre tract about 6 mi. northwest of Sacramento to comprise a completely integrated mill with main group of buildings, to Merritt-Chapman & Scott Corp., 17 Battery Pl., New York, N. Y. Estimated cost $17,000,000.

Calif., San Leandro—Western Waxed Paper Co., div. of Crown-Zellerbach Corp., 1311 63rd St., Emeryville, has awarded the contract for a factory, warehouse and office building to Haas & Rothschild, Merchants Exchange Bldg., San Francisco. Estimated cost will exceed $100,000.

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	.....	.....
Middle Atlantic	$100,000	$2,945,000	$2,100,000	$7,681,000
South	34,000,000	6,300,000	55,067,000	7,455,000
Middle West	3,600,000	3,718,000	4,775,000	4,239,000
West of Mississippi	82,350,000	3,421,000	95,360,000	11,889,000
Far West	150,000	17,500,000	9,650,000	19,082,000
Canada	.....	.....	11,500,000	11,725,000
Total	$120,200,000	$33,884,000	$178,452,000	$62,071,000

Fla., Bartow—International Minerals & Chemical Corp., 20 North Wacker Dr., Chicago, Ill., will construct a phosphate processing plant near here. Work will be done by owner. Estimated cost $1,300,000.

Fla., Panama City—Arizona Chemical Corp., Panama City, will construct a refining plant for the production of industrial vegetable fats from wood. Work will be done by owner. Estimated cost $1,700,000.

Ill., West Chicago—Northwestern Chemical Co., c/o Wrigley, Jr., Co., 410 North Michigan St., Chicago, has awarded the contract for a 1 story chemical plant to Blaw-Knox Co., 122 South Michigan St., Chicago.

Kan., McPherson—Bay Petroleum Corp., McPherson, has awarded the contract for a thermal reformer unit to Refinery Engineering Co., McPherson. Estimated cost $145,000.

Ky., Louisville—Porter Paint Co., c/o J. D. Jennings Co., contractor, 235 East Gaulbert St., Louisville, will construct a warehouse and office. Estimated cost $125,000.

Ky., Calvert City—Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa., has awarded the contract for a fluorine chemical plant to Early Construction Co., 321 Middle Waterway, Tacoma 3, Wash. Estimated cost $3,000,000.

N. J., Camden—General Chemical Co., 1100 Line St., will construct extensive alterations to Bldg. No. 26. Work will be done by separate contracts. Estimated cost $150,000.

N. Y., Brooklyn—E. A. Laboratories, Inc., 696 Myrtle Ave., Zone 5, Brooklyn, has awarded the contract for a 5 story factory at 130 Spencer St., to W. J. Barney Corp., 101 Park Ave., New York, N. Y. Estimated cost $500,000.

O., Cleveland—B. F. Goodrich Chemical Co., Rose Bldg., has awarded the contract for the construction of a chemical plant at Avon Lake, near here, to Sam W. Emerson Co., 1836 Euclid Ave. Estimated cost $3,000,000.

Okla., Oklahoma City—Interstate Oil Pipeline Co., N. E. 10th St., will construct a 37,000 bbl. daily capacity pumping unit. Work will be done by owners. Estimated cost $386,000.

Pa., Allentown—Altoona Rayon Weaving Mill, 3701 Beale Ave., has awarded the contract for a 2 story weaving mill addition to A. J. Stormer & Son, 2275 9th Ave. Estimated cost $125,000.

Pa., Harmarville—Gulf Research & Development Corp., Gulf Bldg., Pittsburgh, Pa., has awarded the contract for the construction of a geophysics laboratory to George F. Seaman Co., 5145 Liberty Ave., Pittsburgh. Estimated cost $920,000.

Pa., Steelton—Harrisburg Gas Co., 14 South Market St., Harrisburg, has awarded the contract for design and construction of a catalytic gas cracking plant addition, including battery of furnaces to be built by Combustion Co., 2375 Dorr St., Toledo, O., to United Engineers & Constructors, 1401 Arch St., Philadelphia. Estimated cost $1,250,000.

S. C., Harleyville—Carolina Giant Cement Co., 1700 Sansome St., Philadelphia, will construct a cement manufacturing plant. Work will be done by separate contracts. Estimated cost $175,000.

Tex., Beaumont—Pure Oil Co., Beaumont, will reconstruct a portion of its refinery at Smiths Bluff. Work will be done with own forces. Estimated cost $550,000.

Tex., Brownsville—Rio Grande Valley Gas Co., Brownsville, will improve and enlarge its gas plant. Work will be done with force account. Estimated cost $115,000.

Tex., Kilgore—Humble Oil & Refining Co., Kilgore, has awarded the contract for an addition to its casinghead gasoline plant to Fish Engineering Corp., M & M Bldg., Houston. Estimated cost $2,000,000.

Tex., Portland—Louis Wohnic, c/o Plymouth Oil Co., Portland, and Weston, W. Va., will construct a glass manufacturing plant. Work will be done by owner. Estimated cost $225,000.

Wis., Milwaukee—Pittsburgh Plate Glass Co., 235 East Pittsburgh Ave., Pittsburgh, Pa., has awarded the contract for a factory addition to Hunsinger Construction Co., 4541 North 124th St. Estimated cost $650,000.